

Aviation Week & Space Technology

June 11, 1962

SPECIAL REPORT:

Air Force 463L Cargo System

By Michael J. Palko

Sikorsky S-64 Skycrane



NEW MATERIALS, STRUCTURES, PRODUCTS FOR LAND, SEA, AIR, AND SPACE

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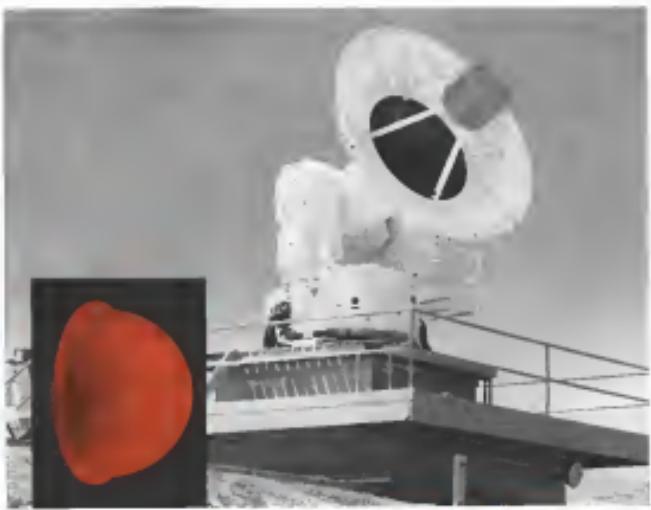
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The men of Aerospace probe all disciplines of the space sciences. Chartered exclusively to serve the United States Government, Aerospace Corporation applies the full resources of modern science and technology to advanced space and ballistic missile systems. As part of the Air Force-science-industry team, the men of Aerospace evaluate and stimulate the free flow of information that results in the imaginative concepts required for national leadership in space. From concept to operation and beyond, Aerospace provides advanced systems analysis and planning, theoretical and experimental research, general systems engineering and commanding technical direction of programs. Aerospace Corporation, an equal opportunity employer, now seeks more men to meet these responsibilities. Highly skilled engineers and scientists with advanced degrees, knowledgeable in interdisciplinary problem solving, are urged to contact Mr. Charles Lohbeck, Room 101, Aerospace Corporation, P.O. Box 95041, Los Angeles 45, California. © Osgood in the public interest and dedicated to providing aerospace leadership in the advancement and application of science and technology for the United States Government.

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CORPORATION



Component molded of **TEFLON® FEP** for low power loss...unequaled weatherability

The antenna feed cover for RCA's AN/FPS-16 radar is molded of a Du Pont Teflon FEP-fluorocarbon resin. This thin-walled precision molding, which serves as a protective cover for a circular-polarization antenna feed structure, takes advantage of the exceptional dielectric and physical properties of FEP resins. Low power loss at both transmission and reception is assured by the low loss factor of FEP resins. Their low and stable dielectric constant minimizes the effect of dielectric on critical phasing of the R.F. energy.

The excellent weatherability of FEP resins, their release properties and extremely low moisture absorption make them ideal for this use, particularly in view of the exposed nature of many radar installations.

& Co. (Inc.), Dept. AV-511, Room 25301, Neurors Building, Wilmington, N.C. 28403.
In Canada: DuPont of Canada Limited, P.O. Box 660, Montreal, Quebec.

TERMS in the *Pen's registered trademark* for *any family of fluorocarbon resins, fibers and films, including TFE [tetrafluoroethylene] resins and PTFE [fluorinated ethylene propylene] resins.*

AEROSPACE CALENDAR

(Continued from page 5)

June 24-26—11th National Meeting, American Meteorological Society, University of Alaska, Fairbanks, Alaska

June 26-29—19th International Symposium on Random and Co-Dynamics, University of Minnesota, Minneapolis, MN, USR, OINR, NASA ("Open meeting")

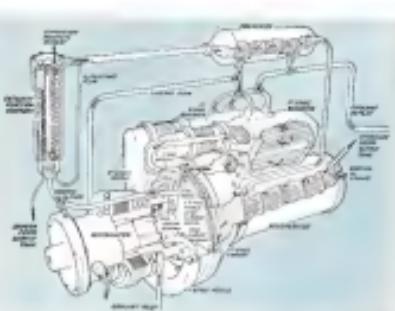
June 27-28—North American Symposium on Computers and Earth Processing by the University of Denver, Denver, Colorado

July 1-2—19th Annual Meeting, American Institute of Radio Engineers, New York University, New York, N.Y.

June 25-29—19th National Symposium on Radio Frequency Interference, Bell Telephone Laboratories, Inc., Holmdel, NJ

July 7-11—19th Annual Meeting, All Wireless Transistor, Bell Telephone Laboratories, Holmdel, NJ

July 12—19th Annual General Assembly, NASTI, Washington, D.C.



A SENSIBLE WAY TO PROVIDE ACCESSORY POWER IN SPACE VEHICLES This is the Sensible GRINNSEPCE... a regeneratively heated, fully integrated power generator and thermal control system. Sensible developed the latest design GRINNSEPCE under a U.S. Air Force Systems Command contract. Powered by hydrazine and oxygen, the GRINNSEPCE is unique in that normally wasted heat from energy conversion inefficiencies and even metabolic heat from the crew is recovered by the patient loop and returned to the power source. The new design for life support vehicles

between each of the four stages of a single-heat helium. Sundstrand has also developed a small stage requalification version of the CRYOHYDROCYCLE for low power levels. This concept results in specific fuel consumption scaling which has not been achieved by any other dynamic space power system. As a result fuel weight and volume are reduced. In addition, the CRYOHYDROCYCLE operates at room temperature, eliminating heat at high temperature materials, solving wheel/rivet/contamination problems, and greatly improving subsystem reliability. Moreover, the CRYOHYDROCYCLE is independent of the environment. It is ideal for Lunar missions. ■ The CRYOHYDROCYCLE is a sensible size, too. About the size of a pencil lead eraser matrix, it can be used in pairs for maximum reliability. ■ Heretofore no kind of space power system is being developed which will be suitable for durations of several months' duration, at power levels from one kilowatt to 50 kilowatts. Both the battery power source (above) and the hydrogen-oxygen fuel cell have been publicly demonstrated to representatives of the aerospace industry and government agencies. ■ (A copy is request of your business stationery and we will send you data sheets concerning this and the other necessary space power systems which Sundstrand and its under development) ■ If you would like to work on the Sundstrand Engineering Team in the development of practical solutions to challenging space power problems, write to: *Personnel Director*.

Answer on page 9





*They don't know it,
but a supply team
'way back in Texas
helped bring them together
in San Francisco via...*

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supplies many of the dependable, factory-new parts and accessories used by American Airlines in maintaining its great Astrojet fleet.



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Southwest Airmotive Co.
MAIN JET ENGINE PLANT: Love Field, Dallas  JET ENGINE TEST FACILITY: Near Avon Cactus Field  SUPPLY DISTRIBUTION: 40 Dallas, San Antonio, Houston, Oklahoma City, Tulsa, St. Louis, Kansas City, and Denver



AEROSPACE CALENDAR

(Continued from page 7)

Aug. 21-24—Quarterly Report Meeting, Von Braun Research Center, Huntsville, Alabama, Andra

Aug. 23-24—Conference on High Altitude Climatic Stability, Climax Springs, Colorado. Sponsored by the State Climatic Laboratory, University of Denver's Research Institute.

Aug. 27-29—AIAA Technical Conference on Advanced Electronic Materials. Sponsored by Franklin Hotel, Philadelphia, Pennsylvania.

Aug. 27-Sept. 3—Third International Congress, International Council of the Aerospace Sciences, New Canaan, Connecticut, United States.

Aug. 28-30—Fourth Conference on Vibration Isolation of Electronic Equipment. Sponsored by the Department of Defense, in cooperation with the Department of Defense University of Colorado, Boulder, Colorado.

Sept. 3-7—National Material Technology Management Conference, Institute of Aeronautical Sciences, Seattle, Washington.

Sept. 3-7—Technical Symposium on Instrumentation Theory, Institute of Radio Engineers, New York, New York.

Sept. 14-16—First Display and Evaluation Society, Society of British Aircraft Constructors, Farnborough, England.

Sept. 17-20—Symposium on Measurement of Aircraft and Vehicle Propulsion Systems. Research Institute, U.S. Army Materiel Systems Research Directorate, USAF Materiel Systems Directorate, Washington, D.C.

Sept. 19-21—Fourth Annual Conference on Applied Mathematics, American Mathematics Society, Hotel Statler, New York.

Sept. 21-23—Climax Meeting, Air Transport and Civil Aviation, London.

Sept. 21-24-25—Annual Engineering Management Conference, IEEE, Hotel Statler, New York, New York.

Sept. 21-24—Hydrogen and Fuel Cells, Air Control Division, Institute of the Aerospace Sciences, Sheraton Hotel, Washington.

Sept. 24-25—Third National Conference & Aerospace Progress, Air Force Arms, Las Vegas, Nevada.

Sept. 24-26—Technical Aerospace Utilities and Materials Analysis, Hotel Statler, Sheraton Hotel, Canada, New York.

Sept. 19-20—Operations & Maintenance Symposium, Aerospace Corp., McAllen, Texas.

Sept. 19-22—Second International Aircraft and Aviation Congress, National Superior Aeronautics School, Gignac, France.

Sept. 24-26—13th International Conference on Composite Materials, Berlin, West Germany.

Sept. 25-27—Space Systems Conference, American Rocket Society, Thomas Hotel, Santa Monica, California.

Sept. 26-28—Series of Experiments Test Pilots, Smith Aircraft Design and Research, Stevens Hill, Seattle, Washington.

Oct. 1-2—Handbook on Dynamics of Manual Lifting, Franklin Hotel, Philadelphia, Pennsylvania. Sponsored by the International Society of Safety, General Chamber of Commerce, Philadelphia.

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PROTECT

THE
60-G
MAN



Preventing injury to personnel at impacts of 60 g's is a problem racing the technical staff at Chance Vought Aerospace. Vought engineers have designed a harness-like experimental restraint system intended to keep man unhampered in hard landings and short accelerations which could be fatal with current systems. Still, this is just one of Vought's projects requiring sound and imaginative scientists and engineers - like you, perhaps. Current programs include SCUD, SLAM, SATURN, CRUSADER, V-STOL. If you are ready to meet the challenge, look into openings with Vought, and aerospace leader offering opportunities for a full and rewarding future in DYNAMICS, flutter and vibration, acoustic and vibration, booster environmental control dynamics and fluid mechanics.

AERODYNAMICS Aircraft, missile, or launch vehicle configuration design stability and control, airloads and aerodynamic heating.

POWER AND ENVIRONMENT Provides solutions to problems relating to thermodynamics, heat transfer and fluid flow from preliminary design through production follow-up.

TRAJECTORIES ANALYSIS Vehicle performance analysis, trajectory analysis of rocket booster systems, familiarity with rocket engine performance characteristics

and orbital and space flight mechanics. Assignment would be in booster vehicle systems, lunar and interplanetary missions and trajectory analysis, and development of advanced methods for solving all types of trajectory problems. Submit your resume to Professional Placement, Dept. AWB, P.O. Box 9907, Dallas 22, Texas.

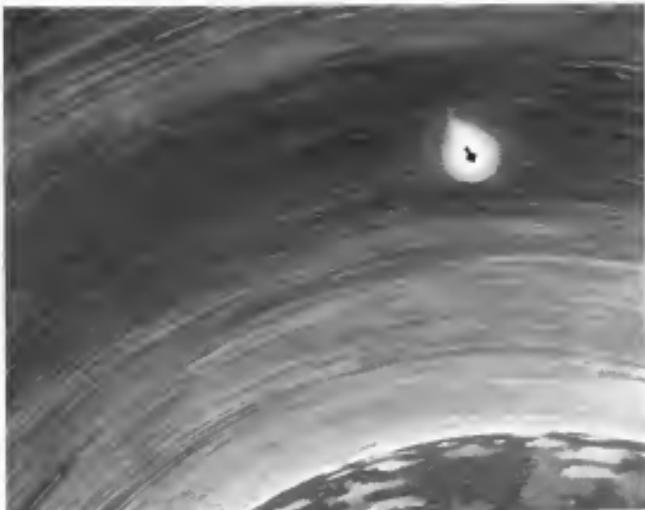
LTV CHANCE VOUGHT CORP.
A DIVISION OF LTV-TEMCO-VOUGHT, INC.
AN EQUAL OPPORTUNITY EMPLOYER

When a space vehicle slams back into the earth's atmosphere at mission's end, a curtain of silence lasting minutes closes between it and its tracking earth stations. A similar communications blackout occurs during the space firing of rocket engines.¹¹ Vibration is another noise generated during re-entry and rocket firing which leads to saturation of atoms and distorts or

ELECTRONIC BLACKOUT

...AND WHAT DOUGLAS IS DOING ABOUT IT

Blackout radio frequencies¹² Because this phenomenon represents an obstacle to remote control of space vehicles, Douglas scientists are studying its exact causes. Work is in progress on methods of modulating or eliminating that interference.



Analysis of radio frequency noise and absorption relative to space flight is one of more than 500 Douglas research programs now underway. Some implement and support such current Douglas projects as SKYBOLT, SATURN S-IV, ZEUS and DELTA. Others range from the study of vacuum deposited thin film materials to the establishment of complete communities on the moon.

DOUGLAS

BURNDY
MAKES ALL TYPES OF ELECTRICAL
CONNECTORS



Accessible, reliable, serviceable...



open and shut case for MS HYFEN.

Miniature rectangular **HYFEN**¹³ provides high density connectors, and is available in 16, 20, 34, 42, 50 & 75 contact sizes with leads to 11.5 mm. Crimp-type snap locked contacts accommodate wire sizes #18 thru #26, and are removable without disassembling connector. Hoods are aluminum alloy, using type, crimped design... can be opened to remove or insert contacts without being removed from connector block. Crimped connections comply with MIL-PRF-20038 milspec with all existing solder types. Complete line of assembly installation tooling available. Write **DOUGLAS** for details.

BURNDY
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Compact

ELECTRIC DRILL



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REVOLUTIONIZES 1/4" ELECTRIC DRILLING!

Half the Size is only half the story

Now, a sensational breakthrough in electric motor design enables Thor to cut both the size and weight of the 1/4" electric drill—in half! Savings in "weight-lifting" (2 lbs. less)—savings in drill-bit life—savings in tool maintenance... add up to an overall 30% reduction in drilling costs! Often pays for itself in a matter of weeks! See the sensational new Thor Compact in your own office. Write, wire or phone Thor Power Tool Company, TW 2-7801, Aurora, Illinois 60001.

THOR POWER TOOL COMPANY, Aurora, Illinois



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TELETYPE

Please have your local Thor distributor bring a Thor Compact 1/4" Electric Drill to my office.

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City _____ State _____



We have two new r-f connectors. They are wee ones.

They are designed to replace N series connectors in the 3 to 10 GHz frequency range where size, weight, and low VSWR ratings are critical factors.

The black one is the BRM, 1.1 mm diameter, 140 semi-dome solder return or threaded or by crimping and crimping. The smaller ferrite core is the BRMM, 0.9 mm dia. 200 semi-dome solder return.

Talk about low VSWR ratings! Look at these curves. The black one is for the BRM, the red one is for the BRMM. The enormous VSWR is less than 1.1:1 over the frequency range of 3 to 10 GHz.

Now, about size and weight. The BRM connector is 1/38 as

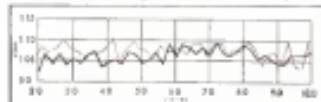
big as its N series counterpart. And it weighs 1/38 as much. The BRMM unit is 1/38 as large as the N series connector, 1/38 as heavy. You might call them minnows. They are.

These precision r-f encapsulated connectors electrical connectors are designed for use in microwave and millimeter波段 over a wide frequency range.

Talk about high performance and excellent conductors. They chose high performance and excellent conductors.

Developed at the Research Laboratories Division of Scintilla, this new series of r-f connectors has been thoroughly protection designed by Scintilla Division for maximum user satisfaction.

Provided you have an application in which the use of our new r-f connectors would be advantageous, Tell us about it. Write us at Scintilla, New York, for technical data.



Scintilla Division





You have to, don't you, John Doe? If you don't, you have problems with high temperature magnet wire, high temperature lead wire, and radiation resistance.

John, the best solution is Hittemp's "Ceramalamp." It's a nickel-clad copper conductor insulated with a ceramite-like material, firmly adhered to the conductor. Rated for continuous operation at 1000°F, or even 1199°F for short periods of time, Ceramalamp is inert to solvents, oils, organic materials, thermers, and hydraulic fluids. Available in sizes 10-49 AWG, its abrasion resistance is very high, too. Useful, eh?

Hittemp's Engineering Department will help us meet

special requirements using modified Ceramalamp construction. They've also got a new product—Ceramalamp—for potting and encapsulating. We oughta ask about that—I'm sending for their "Condensed Catalog" at the same time.

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We're putting all space under one roof at Northrop

Northrop has long been vigorously dedicated to the investigation of space, with a wide range of active programs and advanced research facilities distributed throughout its several divisions. Now all these varied space activities have been brought together under one management at Northrop Space Laboratories.

Through this realignment, each space program will be assured of getting the maximum concentration of scientific,

technical, and managerial talent. Moreover, all programs will be backed up by the experience, capabilities, and manufacturing facilities of the entire Northrop Corporation.

Northrop Space Laboratories will be located in Hawthorne, California, where new, completely equipped research facilities are now under construction.

NORTHROP

Practical temperature measurement from 1°K to 7000°F

7000°F 4140°F	ROCKET FUELS COMBUSTION RANGE (Solid-fuel Radioactive Pyrometry)
5000°F 2833°F	INDUSTRIAL PROCESS RANGE (Infrared Radiometric Pyrometry, Borrowed)
200°F	
344°F	BIOMEDICAL RANGE (Infrared thermal systems, radiometric thermometers, thermocouples)
0°F	
289°F	ENVIRONMENTAL RANGE (Infrared systems, radiometric thermometers, Type T thermocouples)
-320°F	
100°F	CRYOGENIC RANGE (Infrared radiometric thermometers)
-460°F	
0°F	

Honeywell supplies world-wide accurate oxygen thermometers filled with thermocouple resistance thermometers, thermistors, and infrared sensors. Pyrometers to measure temperatures from the very bottom of the temperature scale to well beyond the operating range of most rocket propellants and propellant combinations.

Honeywell supplies filled heat-flush thermal systems, resistance thermometers and thermocouples for very close measurement of temperature under widely varying conditions.

FOR THE NEW WORLD OF CYTOGENETICS Today enormous rocketry, altemans, and microtectonic processes are depending close and close on applied cytogenetics, the world's witness of extremely low temperatures.

GOING UP THE SCALE in the practical use and measurement of heat, the Industrial Pyrometer Range is reached. This extends roughly from 300° F. to 5000° F. Honeywell makes a number of standard sources for use in this particular range infrared, infrared, incandescent Pyrometers and many types of thermocouples, each of which has its own individual measurement range and sphere of usefulness.

possibilities. An consistently improved and more effective cryogenic tools—valves, pumps, etc., are developed to broaden the useful application of expansion. Hiscoxell keeps pace in applying instruments for measuring and controlling extremely low temperatures.

TO 7000° Beyond the Equational Proton Range lies another which may conveniently be called the **Rocket Fuel Combustion Range**. In this, temperatures reach up to **7000°** (4000 K). Most rocket propellants and combinations of propellants have combustion temperatures below this figure, which is the upper limit of Haugwitz's small-tube refrained **Bottomless Pyrometer**.

Available in probe, resistance contact, and threaded insertion models, it provides a relatively strong signal output that can be accurately measured and recorded by means of standard pressure indicators, such as Honeywell's model 2000.

If you are involved in the management of high, low, or intermediate temperatures, Honeywell can undoubtedly be of help to you. In addition to its extensive line of temperature control equipment, Honeywell offers the complete responsibility for system implementation and service systems. Thus Honeywell can help you to select the right system and maintain its reliability. If you are doing work that involves temperature estimation, salt production, Honeywell Branch of the Minnesota State Highway Department, Wayne, Ontario, N4G 1C6, Canada; Honeywell Controls, Ltd., 700 Route 73, Ontario.

GETTING WARMER, the Environmental Range (30°F to 10°F) is reached here extremely cold, such as that encountered in space stations, cannot be accurately measured. Beyond that is the Beginning Range, a narrow band extending roughly from 10°F to 30°F within which all life functions are possible. For both of these ranges

Honeywell
H *Fast in Control*



Clearway through the weather

all-weather operation and automatic landing is a crucial sector of aerospace development, in which SMITHS can claim an unequalled record of pioneer work and practical progress. Already more than 8,000 fully automatic blind landings have been accomplished, without incident, by aircraft using the Autoland system evolved on the basis of the SMITHS Autopilot. The latest outcome of SMITHS initiative in fundamental research is the Para-Visual Director. This is an entirely new concept in flight director display, which can be applied to existing instrument systems. By presenting essential information to the pilot, even as he concentrates on the runway ahead, it effectively eases his task—especially in high-speed, low-visibility landings by modern jet aircraft.



The various Posts should therefore be P.V.D. stations and garrisons in the public, so as entirely to dispense with information journals available only by the postmaster, and if necessary of small "Post Office" units established when the various posts are situated in the same town. One post master should be in charge of the entire of the area. The post master should be responsible for the entire area, and the post office should be the central organization of the area's regional system, differing by no means from the various posts.

The P.V.D. normally being organized by E.C.M. and other ordinary and unordinary posts, and the joint of the various posts on Flight Control Systems cancelled as the P.V.D. is the principal "Traffic" - the first element amongst to be specifically designed for all possible traffic.

SMITHS AVIATION DIVISION

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Australia: 40-52 Ferndell Street, Guildford, N.S.W.



Hide...and Seek

On patrol in the icy Arctic night, the U. S. Navy's destroyers can now "see" supersonic enemy targets at long range. Their new SPG-50 radar, designed and built by Lockheed Electronics, now gives them greater range in pinpointing airborne targets.

Lockheed's creative systems designers achieved these results with a unique pulse compression system that increases the range-to-weight ratio of shipboard radar equipment and improves its resolution as well.

Lockheed's experienced perhaps engineers this complicated system into rugged dependable units. For example, new welding techniques provide惊人的ly high strength-to-weight ratio in the antenna resulting high above the destroyer's deck.

Lockheed Electronics engineers follow-through teams are carefully supervising installation and checkout, helping to train Navy operators and maintenance specialists, and staying with the equipment until maximum performance is achieved.

Lockheed offers these creative, practical and follow-through capabilities to the defense and civilian electronic industries alike. LEC is the electronics gateway to several thousand scientists, engineers and technicians who work for Lockheed.

Engineers and Scientists. For unique advancement opportunities with this talented team, please contact our Professional Placement Office, Plainfield, New Jersey.

LOCKHEED ELECTRONICS COMPANY

PLAINFIELD, NEW JERSEY

A Division of Lockheed Aircraft Corporation

EDITORIAL

Reliability in Space

The premature end of the useful life of the Orbiting Solar Observatory (OSO) last week due to a mal-functioning spin control system (see p. 38) offers a good example of why the National Aeronautics and Space Administration is demanding from industry a totally new standard of reliability, or quality assurance, as the agency pushes to cut it. Quality assurance is a phrase that will have a special meaning in all current and future NASA dealings with its contractors. It will also have large in the performance records that NASA is now keeping on its contractors as a guide for its future contracting.

OSO was intended to provide a wide variety of solar data during its orbital life of six months. Instead, a relatively minor mechanical malfunction deprived the entire complex scientific life of all of its useful fractions at the end of 11 weeks. Another similar example of how small imperfections can cause expensive mission failures is the Ranger program. In four Ranger shots—at a cost of about \$17 million per launch—the failure of relatively small portions of the total space vehicle system have kept this project from achieving the major goals of the program.

Problem Is Magnified

The problem of achieving 100% reliability in space exploration vehicles is tough enough, but the problem becomes even more acute when the space age moves—in a short time—into operational satellite systems for weather reporting, navigation, reconnaissance and communications. For in these systems a single minor component failure in a single satellite could disrupt the functioning of the entire system for the interval it would take to fix a replacement vehicle into the proper orbit. That would prove to be an extremely expensive process if the failure rate reached as high as the statistical rate now generally acceptable in high quality control industries.

Because of the stringent weight limitations that space vehicles will have to live with in the foreseeable future it will be impossible to add sufficient duplication of systems to achieve the standard of perfection required for long periods in the cruel environment of space.

The elaborate research and test facilities developed for vehicles operating in the atmospheric envelope have never fully achieved a complete simulation of all the conditions of actual flight over the time periods that are significant for operational use. But they have come

much closer than it will be possible to achieve with simulation and environmental hot tubs seeking a true spacecraft environment. Virtually every industrial firm and government agency in the space business is now busily creating and building a wide variety of space environmental simulators. No matter how useful these prove to be, they will still fall short in major areas of true space environmental simulation. This is perhaps the most compelling reason for developing as soon as possible large manned laboratories operating in space where the stringentities of its environment can be fully felt, measured and studied for significant periods.

Manned Systems Requirement

When manned space systems are considered, the 100% reliability requirement becomes even more stringent. NASA and its industrial contractors on the Mercury, Gemini and Apollo programs face reliability requirements far greater than anything set aside as earth-based engineering systems, and they must be achieved in this brutally hostile environment of space.

Not only will new concepts be required, but we will new equipment and operating techniques in developing these immensely high standards of quality control and reliability. Such a philosophy will also play an important role in basic design of space hardware. Inevitably it will produce a liftoff into the entire industrial complex that will be in improved performance at lower cost.

The aerospace industry has always been a leader of general industry in the concept of precision engineering and quality controlled production. It is now facing a new and even stiffer challenge to raise its already high standards to meet the requirements of space technology. NASA has hired General Electric Co. to serve as its technical advisor on how to achieve these new standards, oriented primarily toward the Apollo manned lunar landing mission. But it also will require all of the best talents available throughout the industry and other government agencies to achieve fully these goals within the time limits set by international competition.

These new requirements of quality assurance and reliability are a hurdle that must be cleared if NASA's ambitious manned space program is to reach its immediate goals. They also present a tremendous challenge to the management and technical direction of every firm in the aerospace business, and will be a major measure of their future success.

—Robert Ross

TOUCHDOWN ON THE FIRST PASS

A new air traffic surveillance system, Texas Instruments ASR-4, provides accurate position information on this jetliner and other traffic within 60 miles. Result: touchdown on the first pass.



Look to TI for answers to your radar problems in—

- air surveillance
- ground surveillance
- subsurface detection
- missile guidance
- fire control

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WHO'S WHERE

In the Front Office

R. Douglas Lowery, president, Chrysler Corp. 3, Springfield, Mass., Defense, Inc., was promoted to chairman. J. M. McLean, Jr., remains chairman.

Wilkins R. Ross, president, Eds Corp., Carter, Fort, N. Y., succeeded **Neil B. McLean**, now board chairman. McLean succeeds **Edmund D. O'Brien**, who has McLean will continue as a director, executive and a member of the administrative committee.

Group Capt. E. Penrose, a director of Dextra, Ltd., London, England. Group Capt. Penrose is managing director of Dextra Radio and a director of the aircraft division of British Steel Corp., London.

R. Donald Capers, vice president, power and motion systems, Aerospace Div., Avco Corp., Gardner, N.Y. **Willard L. Lai** was promoted to director of the Avco power and motion systems division of the Avco Division of Avco Corp., Woburn, Mass.

John E. Kitterman, director of the Avco Aerospace Div., the Avco Division of Avco Corp., Woburn, Mass.

Edward O. Kitterman, vice president and assistant to the president of Aerodynamics, a division of North American Aviation, Inc., Downey, Calif.

Robert M. Barnes, a vice president, General Precision Electronics Division, Cleveland, Calif.

Irvin C. Polkson, vice president, missile testing, TSDR division of Aerophysics Corp., El Segundo, Calif.

Keith M. Sorenson, vice president, marketing, Consolidated Photoelectronics Corp., Pacifica, Calif., subsidiary of Bell & Howell Co.

Ernest U. Glaser, vice president general manager, Instrument Components, a division of the Avco Corp., Woburn, Mass. **Mr. Glaser** is vice president and director of the Research & Analysis Division.

George T. Bunting, vice president, operations, Eastern Metallographic Corp., North Chicago, Ill., and **Ralph W. Rasmussen**, vice president, research, a division of Eastern Metallographic Corp., North Chicago, Ill.

Titan World Airlines has announced the appointment of the following regional vice presidents: **R. Paul**, Rockford Airlines, Region (New York), L. E. Stott, Western Region (Seattle), and **T. W. Johnson**, Region (Knoxville, Tenn.).

Jack F. Morris, a vice president, The Tyco National Co., Chicago, Ill., and general manager of the Chicago Division.

Donald R. King, a vice president, public relations, Comsat, Inc., Long Island, N.Y. **John R. Knapp**, another vice president, is flight test manager.

Donald A. B. McLean, vice president and director of operations, Defense Electronics, MELCO, Inc., Defense Industries Division.

Mike Mancuso, vice president, president, Northeast Orient Corp.

R. Alvin Mills, assistant vice president, power products, American Airlines Inc.

Col. Richard H. Curtis (USAF, ret.) director of the Mobile and Space Control Center, Air Force Space and Missile Test Center.

Al Merle D. M. F. Gandy, controller of Guided Weapons and Electronics, Ministry of Aviation, London, England.

(Continued on page 124)

INDUSTRY OBSERVER

► Left diagram shows the payload to be used in testing the Gemini Inertial Experiment (GIE) which will be 1-2,000 ft. from that of the Pioneer planetary research vehicle now flying at NASA's Flight Research Center, which has a rate of 14, and the North American X-15, with a rate of 15. The payload will give Gemini a capability of maneuvering to shift its landing point by 25 m during a 15-min. flight.

► Determination of the requirements of the VAX close-support aircraft is involving a final decision on the F-111A (CVF) multi-purpose tactical aircraft. However, several companies are known to be submitting proposals embodying both conventional attack and landing and VTOVL characteristics.

► Apollo survival problem simulation is about to begin in the five-degree oblique simulator at NASA's Ames Research Center. The combination of today, tomorrow and geobidirectional rocket version has just completed a series of supersonic transonic control studies.

► Glass-reinforced pressure cables used in some of the newest jet aircraft could be fabricated in a new glass-winding facility being constructed for United Technologies Corp., according to a UTC study. The technique of manufacturing pressure vessels has never been used on anything larger than a solid propellant rocket case, but UTC scientists have modified its application to structures up to the size of a reentry hull.

► Possibility of a thrust modulated, restatable solid propellant rocket is now being demonstrated by Alliant-Causal Corp. A number of these rocket motors have been fired successfully.

► Thailed first stage of the Minuteman solid propellant intercontinental ballistic missile carries 47,000 lb. of ammonium perchlorate mixed with 17% of powdered aluminum. In adding the oxidant to the basic material there is a highly exothermic period of 12 sec. for curing of the highly volatile combination. Specific impulse of the missile is 190.

► Alliant-Causal Corp. is about to make a comparative test of solid propellants and nitrogen tetroxide in liquid oxygen/thrust vector control boosters in a two-stage-to-orbit flight of a seven-and-a-half solid propellant rocket. The first stage will be the solid rocket, the second, a Titan 3 stage will be boosted immediately after the solid stage to increase velocity. The second stage of the Titan 3A Standardized Space Launching System (formerly called Titan 3 (AW) May 28 p 29). Fluids will be pumped through the Titan plumbing during the test.

► Use of white cockpit and instrument lighting in place of red is spreading. Both Federal Aviation Agency and Air Force representatives reacted favorably to the system in the Lockheed C-141 cargo transport at a recent week-long review. Air Force has introduced the system into the Northrop T-38 jet trainer and the Lockheed C-141B.

► Army Transportation Research Command plans to award one to four contracts for operational studies of the use of ground effect machines in support of Army's cold and hot logistics mission.

► Air Force Ballistic Systems Division will issue call for industry proposals for development and production of integrated high-frequency radio systems to be used to withstand high-level nuclear weapon effects. Delays in the first production units is to be within approximately one year.

► An F-105C speech to reconnaissance which has been ordered by Secretary of Defense Robert S. McNamara will combine all military intelligence gathering requirements into one package. Regardless of the type of system, electronic, infrared, photographic or "optical", they will all be integrated to fit the aircraft with no duplicative effort. Studies will be completed July 15.



GUIDANCE COMPUTER
for NASA'S CENTAUR

Sometime this year, CENTAUR will be apocryphic. Already, the projected uses of CENTAUR bear fascinating implications for the future... placing a satellite in an orbit so exciting that it will remain in one spot over the earth's surface... soft landings on lunar and planetary bodies... timed launches of several satellites from a single vehicle. Several major guidance functions will be performed in CENTAUR by a compact digital computer system from Librascope. It weighs 62 pounds, occupies little more than $\frac{1}{2}$ cubic foot. A note to Librascope: solving your control problems will bring a prompt answer from the country's most versatile manufacturer of aerospace control systems.

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 GENERAL
PRECISION

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Washington Roundup

Anti-Secrecy Campaign

House Government Information Subcommittee has launched its campaign to force the Defense Department to issue a declassified version of the directive during military spending hearings. (AW May 23, p. 30)

Subcommittee Chairman John Moss in a letter to Defense Secretary Robert S. McNamara said that Under Secretary of the Air Force Joseph Clark, chief author of the directive, has "indicated that the directive is question which is presently classified could easily be declassified by means of a deletion to a simple revision."

Rep. Moss contends that classifying the directive has caused widespread confusion about its intent. "Experts who have studied the history of securities and censorship of defense information in the U.S. have found that the government's major efforts in the field have been successful only when the fact of censorship has not itself been exposed," Rep. Moss told McNamara.

Subcommittee staff members recently discussed the directive with Clark. In his letter, Rep. Moss asked McNamara "to take the steps necessary" to provide a declassified version. Subcommittee hearings on the space secrecy policy will be next step.

An F/A-18 Hornet/TFX tactical fighter program has encountered still another delay (AW May 23, p. 21). Defense has directed the Aerospace Systems Division at Wright-Patterson AFB to review the performance requirements in determine if they can be improved to enable Air Force operations. Review probably will take the current award, originally expected the month, until July.

Space Use for Fluorine

Possible use of fluorine as fuel for such space vehicles as Centaur will be explored soon in House space subcommittee hearings being held by several industry leaders in an evolution of a congressional committee action last year.

House hearing, to be chaired by Rep. Joseph Keith and traditionally scheduled for June 15, coincides with Senate space committee consideration this week of the National Aeronautics and Space Administration Fiscal 1963 budget. The budget authorization bill, as sent to the Senate by the House, provides \$500,000 for work on high-energy fuels such as fluorine and boron roxocarbon.

Rep. James Fulton of Pittsburgh, sound ranking Republican on the House space committee, sponsored the high-energy fuels amendment. He is trying to persuade Chairman Robert Kerr of the Senate space committee to double the \$500,000 authorization. Projects for this action are brightened by the fact that Cullen Chemical Co., a producer of high-energy fuels and roxocarbon, has facilities in Oklahoma, See Kerr state—as well as in Pennsylvania.

Bell Aerospace Co. has been working for several years on roxocarbon using a Liquid Fluorine Oxidizer system developed with thrust levels reportedly as high as 35,000 lb. Bell is a probable winner for the House hearings. Rep. Keith approaches the hearing with the hope, but certainly not the conviction, that fluorine eventually can be used in Centaur in anyone's performance.

RS-70 Funding Status

Question of how much money Congress should appropriate for the reconnaissance-size version of the B-52 boulder is headed for a House-Senate conference. Senate Appropriations Defense Subcommittee has work well along with the Air Force and recommended \$491 million for Fiscal 1963 to develop six aircraft, rather than the planned three. House-passed bill would appropriate \$323.9 million for the program—\$12.9 million more than the \$317.1 million President Kennedy requested (AW May 23, p. 35).

Senate and likely will adopt its subcommittee's recommendation. Resulting House-Senate conference may split the money difference in this bill. But how much Defense will spend on the RS-70 is still an open question. The main part of the RS-70 review McNamara referred will be being studied by Air Force Under Secretary Chayik.

Combat Foc's* Strategy

Senate opposition to the House-passed bill to establish a private corporation to operate a communications satellite system already is employing delaying tactics in hopes of killing the measure. Thus, stated Sen. John F. Kennedy, the Senate will file their minority report and try legally opposing a filibuster.

Meanwhile, Federal Communications Commission Chairman Newton Minow publicly expects firm that the Kennedy Administration will be bound when publicly-bought communications satellite equipment steel, fails to yield dividends for the first few years.

Says man of Marshall Space Flight Center's Future Projects Office, whose personnel would manage development of the giant Nova space booster if the much-disbursed project ever gets under way: "Nova-Nova" would suddenly be magnified in size and power, in some cases becoming the brightest object for a few days. "They then fade away and disappear."

—Washington Staff

DOD to Standardize Aircraft Designations

Common system agreed upon by services to be implemented soon; use with present aircraft studied.

By Larry Boada

Washington—Uniform system of designations for all military aircraft will soon be put into use by the Defense Department. All of the services have agreed on a common list of letters and terms, for new aircraft and some earlier development, but the question of scaling the system include aircraft already in service is under study to determine the cost.

Impetus for the order came from Defense Secretary Robert S. McNamara, who has supported before a congressional committee late in February to discuss an Air Force purchase of the Navy-developed McDonnell F4H-1F fighter. One congressional kept referring to the F110, which is the Air Force designation for the aircraft, and McNamara insisted that the purchase was for the F4H. They were flying about the same aircraft. The angle system order was issued the next day (AW, Mar. 19, p. 25).

Specific configurations (ECM) or other special electronic role it would be given would be picked up under existing status, etc., for example, it was an experimental aircraft, and a modified mission symbol would be added to a mission symbol other than the original capability. These would be followed by a design number and a series symbol. A modified mission symbol or source code would complete the designation (see box).

A new experimental aircraft recently built by the Douglas plant at Long Beach, Calif., would be designated the XA-1ADL. When it became operational it would be the A-1ADL. If it was modified to fit an electronic

category will begin with "P" and the series symbol with "T." The latter letter comes after "H" because the letters "D" and "O" will not be used, due to the possibility of confusing them with the numbers 1 and 0.

When the draft was submitted to McNamara four weeks ago, his reaction was that the basic purpose of the change—overcoming current confusion over aircraft—had been met, but that changing thousands of documents would cost a substantial amount of money.

For each aircraft there are thousands of drawings, which are used not only during original construction but for subsequent overhaul. These are pilot and maintenance handbooks and many other publications given wide distribution to the services and industry which provide a single guide.

In preparing the draft directive for inter-service application McNamara said: "However, I do feel that a study be conducted of all aircraft to which designation have been assigned in determine the practicability of continuing to use the existing system. Whenever this review can be made without significant cost or confusion, I desire that the standard system be adopted. This is particularly important in those cases where equipment has already been used by one or more departments and now have different designation."

McNamara assigned the study to Thomas D. Morris, assistant secretary of defense for installations. He is



Hound Dog Displays Low-Level Capability

USAF/North American GAM-77A (Bomed Dog) aircraft makes a low-level flight over White Sands Missile Range, N.M. Missiles operational with the Strategic Air Command, has a speed exceeding Mach 2 and a range of more than 600 mi. Low-level capability is designed to enable it to penetrate to target by evading radar detection.

being helped by representatives from each of the services. The recommendations are due back to McNamara by May 1.

These are the symbols and numbers and their definitions, listed in the order in which they should appear in an aircraft designation:

■ **Series prefix symbol.** If applicable, this letter will indicate an aircraft or missile being used for experimentation, service tests or some other special purpose.

■ **Modified mission symbol.** If used, this letter will indicate the mission capability of an aircraft or missile when it has been modified so that the original capability has been deleted. It also has an added or restored capability.

■ **Base mission and type symbol.** This latter will denote the primary function or capability of an aircraft. In the case of launching VTOL and STOL aircraft and transports, a second letter in denoting type will be used. An example will be the responsive RS-70 bomber, which will have the mission-type R/S symbol.

■ **Design number.** A consecutive series of numbers beginning with 1 will designate each new design of the base mission and type of aircraft. Examples are the F-100 and the F-101.

■ **Series symbol.** These will be consecutive letters of the alphabet used to denote different aircraft models of employment, different aircraft configurations, E—special electronic configuration, F—fighter, H—type symbol designating

aircraft and major modifications to the aircraft which result in significant changes in the aircraft's purpose.

■ **Source or manufacturer's code.** A two-letter code will be used to identify the prime or assembly contractor.

Air Force Rule

As Air Force will be responsible for establishing the criteria and assigning new designations, Prototypes for implementation the system will be assigned to aircraft by the Navy and Army.

■ **Serial numbers.** Those which have not yet been assigned, as appendices containing the currently assigned designations and the previous codes associated with them will be published.

The directive is applicable to existing, developmental, test and training aircraft and missiles.

■ **Series prefix symbols.** A—attack, B—bomber, C—cruise missile, D—dilector, E—special electronic configuration, H—missile and missile, I—tugger, L—cold weather, M—missile carrier, Q—drone, R—missile, S—air-to-surface, T—training, V—utility, V—missile, W—weather.

■ **Modified mission symbols.** A—attack, B—bomber, C—cruise missile, E—special electronic configuration, F—fighter, H—type symbol designating

aircraft, K—missile, O—observation, P—missile, S—air-to-surface, T—training, U—Utility, V—type symbol, VTOL and STOL, X—missile, Z—type symbol.

■ **Design numbers.** A two-letter code for assigning production numbers to blocks in multiples of five. Each service will have responsibility in the assignment of serial numbers.

Oscar Radio Satellite Misses Planned Orbit

Los Angeles—Orbit 2 amateur radio satellite and its Oscar 1000 communications satellite apparently missed their planned orbits after launching on a modified Atlas-Centaur rocket which was to have placed them into orbit at 22,000 mi above an inclination of 73 deg.

These tracking net had anticipated that first acquisition would be at 14 minutes in orbit. However, the satellite became not detected until it was acquired by stations in France and England on the northbound side of its first orbit. Reports indicate that separation of the 1000 amateur radio satellite from the Oscar 1000 communications satellite was successful. It is transmitting Morse code letters in identification. Rate of transmission indicates that the internal temperature of the satellite is 54° F. Period of the orbit is 90 min and the satellite is expected to continue transmitting at a frequency of 144.995 mc for more than a month.

Aircraft Manufacturers' Code Letters

Sealed	Manufacturer	Address	Sealed	Manufacturer	Address
AE	Aerospace Corp.	Middletown, Ohio	HU	Hill Helicopter	Palisade, Calif.
BB	Bell Aircraft Corp.	Watertown, Mass.	HU	Hill Helicopter	San Diego, Calif.
BF	Bell Helicopter Corp.	Towcester, Mass.	KA	Kennon Helicopter Corp.	Winter Haven, Conn.
BN	Boeing Co.	Seattle, Wash.	LM	Lockheed Aircraft Corp.	Meriden, Conn.
BO	Boeing Co.	Seattle, Wash.	LO	Lockheed Aircraft Corp.	Bethel, Conn.
BN	Boeing Co. (Virtual Div.)	Moorpark, Calif.	MA	McDonnell Co.	Edison, N.J.
BW	Boeing Co.	Wichita, Kan.	MB	The Martin Co.	Desert, Calif.
CS	Convair Aircraft Co.	Wichita, Kan.	MF	The Martin Co.	Orlando, Fla.
CF	Cessna	Fort Worth, Tex.	MC	McDonnell Aircraft Corp.	St. Louis, Mo.
CO	Cessna	San Diego, Calif.	MD	McDonnell Aircraft Corp.	Memphis, Tenn.
DM	de Havilland Aircraft of Canada	Toronto, Ont.	NA	North American Aviation, Inc.	Inglewood, Calif.
DM	Deutsche Helicopter, Inc.	St. Louis, Mo.	NA	North American Aviation, Inc.	Columbus, Ohio
DL	Douglas Aircraft Co., Inc.	Long Beach, Calif.	NI	North American Aviation, Inc.	Downey, Calif.
DO	Douglas Aircraft Co., Inc.	Long Beach, Calif.	NO	Northrop Aircraft, Inc.	Hawthorne, Calif.
DR	Douglas Aircraft Co., Inc.	Toluca, Calif.	PA	Pan American Corp.	Philadelphia, Pa.
FA	Fairchild Aircraft Co.	Hagerstown, Md.	PA	Piper Aircraft Corp.	Lock Haven, Pa.
GO	General Aircraft Co.	Albion, Ohio	RE	Reedell Aviation Corp.	Flemington, N.J.
GT	General Aircraft Co.	Yonkers, N.Y.	RT	Ryan Aircraft Corp.	San Diego, Calif.
GR	Grumman Aircraft	Bethpage, L.I., N.Y.	SW	Sikorsky Aircraft Corp.	Elkhorn, N.Y.
GT	Grumman Aircraft	Bethpage, L.I., N.Y.	SE	Sikorsky Aircraft Corp.	Stratford, Conn.
HE	Heinkel Aircraft Corp.	St. Louis, Mo.	TA	Tucker Aviation Corp.	Ashland, Ohio
		Newark, Mass.	VD	Chance-Vought Aircraft	Dallas, Tex.

Douglas Views Profits Shift as 'Possible'

By Katherine Johnson

Washington—Faced for getting a prime contractor's profit on subcontracted work to the prime contractor's own client, rather than as an attorney's fee of the prime contractor's profit lost in the subcontractor's profit, we would be in "peculiar" position," says Douglas, president of Douglas Aircraft Co., in the Senate Permanent Investigations Subcommittee.

The report, released last week, was an response to a request by Sen. John McClellan (D-Ark.), the subcommittee chairman, for Douglas' view on profit-pooling contracts. "Management fee" for recovering the cost of subcontractors (AW, Apr. 16, p. 116) leaves the subcontractor with a "margin" profit for subcontract work and a "margin" profit on the performance of standard subcontract items.

If the prime contractor's fee is to be increased as a percentage of his own profit, Douglas gave the writing on his comments to the subcommittee:

"So as doing it would be expensive

to

the prime manager should have in the proportion of 10 percent.

"On the other hand, the practice of

limiting the fee base for management

to a certain cost will give the government contractor an advantage in performance in return as much work as possible relative to the possible detriment of all other contract performance.

"No matter what technique is used

for arriving at an appropriate ratio to the system manager the end result should be an efficient management for the benefit of the taxpayer and the benefit generated by the program."

At the conclusion of the hearings,

as an example Douglas noted that

Thomas D. Morris, assistant secretary of defense for installations and logistics, announced that Defense Department has learned a "recommittal" of its practice of giving a standard profit rate on subcontract work. The issue is in whether "over price" measurement and rate of the contractor's subcontracting, allowing a high profit rate where the subcontractor is a "competitor" responsibility for subcontract work and a "margin" profit on the performance of standard subcontract items.

Douglas proposed that an adequate subcontractor standard profit rate, or "margin" dollars could be recovered if the manager permitted to compete for management system contracts were limited to the owner or vendor "very quickly in a fixed fee." Noting that procurement for construction costs from \$160,000 to \$793,000, Douglas asked "if it isn't reasonable that 15 percent from repeat business it is clear at the outset that this is not true, we are truly qualified."

Douglas said that the "margin" would be decided by the defense industry to "protect, gain-protect, or wholly improve, and meet procurement standards that definition."

He said that some government policies toward the defense industry now tend to "confuse" procurement and procurement managers who contend with doing business in the American way."

Reaggression, Douglas said, "has in fact brought a reappreciation for local origin contractors."

With respect to the defense industry, Douglas and the government "virtually accept the traditional concept" under which "the commercial business can normally be expected to engage in advertising, not simply to sell its products, but also to establish a reputation that insures participation by high caliber providers, to attract maximum bid competition, to suggest competitive prices, and to incur an community obligation."

Douglas also commented on these other controversial points in procurement policy:

- **In-house capability.** The military services should have the capability to determine requirements, procure or form a single contractor, or when best-a-single purchase form a distinctive inter-become feasible, from a number of firms, select and evaluate the procurement and plan and negotiate the subcontractor's performance requirements. Beyond this, Douglas said, it would detract from performance of these functions and from the primary function of the senior services, if the services undertaken the detailed management of all aspects of a development program."

- **Non-pooling arrangements.** Their access to the know-how of many contractors and the essential requirement that

although Douglas Aircraft performs no contract for propulsion systems, in guidance systems, the company, as a prime contractor, needs the in-house capability for overseeing and evaluating these types of subcontracted work. "The costs and time paid to the owner are high," he stressed, "must be reflected in payment to these capabilities."

Douglas proposed that an adequate



First Drawing Shows Shillelagh Configuration

Artist's concept shows final configuration details of the Army's Shillelagh guided missile, under development by Ford Motor City's Aerospace Division, Newport Beach, Calif. Shillelagh incorporates fin stabs on folded booms and spring out (as shown) after launch. At end of stroke its folded booms against which fins are folded on the launcher.

they lack is a "regime that they intend to be a low and limit their rate to that of a single contractor than a 'don't'." Douglas observed.

• **Industrial system manager.** Douglas stressed the advantages to the government of having an industrial system manager during the development and

early production phases of a weapons system.

The industrial manager, he said, can accomplish the job better

and more inexpensively than a

government can do, and when the job is done, the government has no

further obligation to the contractor.

In house government management,

he noted, would incur the re-arrangement of skills at the end of each project.

The prospect of a production contract, Douglas said, "restores efficiency during development." The industrial manager won't over-engineer the system as might be the case with a contractor whose only service and source of compensation is a fixed development

contract. "More," if not all, of the system options will be provided by the government, he said, as a general potential," Douglas observed. "It is an early day in production, the components of the system are broken out for procurement from many sources, that potential cannot be realized easily as well as if the system is made through a single source."

"As design problems become fewer and fewer, the contribution of the prime contractor diminishes, and the should be taken into consideration by reorganizing firms in accordance with the decrease in contribution."

Start of production work on the program was set for a start of a strike by Republic Aviation's new chief (AW, Apr. 9, p. 15) which is to start in about 18 months. Negotiations have been completed for the transition between management and the prime contractor, but both parties are as yet to be selected to manage the contract.

When the system manager no longer has a substantial contribution to make, and when no major program changes or redesigns are necessary, then we certainly agree that the government should buy directly, after weighing its own costs of procurement against the costs of procurement through a prime contractor."

Legislation Would Aid Bureau of Standards

Washington—House Science and Astronautics Committee has work started in effect to pass the National Bureau of Standards reorganization for its scientific research program.

Committee Chairman George P. Miller (D-Calif.) long has felt that the work of the bureau has been hampered by never agreeing with less scientific accomplishments. He called the bureau the "youngster" of the government scientific agencies at the opening hearing on a bill to authorize the bureau to employ design scientists.

Benders, according to a committee hearing, has been a "lame duck" in legislative respects, the bureau, because of Rep. Miller's attitude, will have more opportunity to exploit its scientific accomplishments. Within the next few days, for example, the bureau is expected to hand the committee an its work with lasers (AW, Mar. 26, p. 415).

The legislation now being considered by the committee would authorize the bureau to employ scientists from foreign countries for up to two years. A V. A. Atoms, bureau director, and his authority would help his agency 300 less spent on scientific research in scientific quality and most worldwide projects by just using manpower for bureau citizens in foreign countries.

Atkins estimated 25 foreign scientists would be employed by the bureau at a total cost of \$760,000 a year if the bill were passed. The scientists would come only from U.S. military sites.

Virtel Wins SOR 190 Contract

Washington—Rogers Ward 307 million passenger tandem seat helicopter has been chosen as the Army's first to serve as a heavy transport aircraft. The aircraft will be built with fast leading to cause from reprogrammed Fiscal 1982 appropriations.

Requests for proposals which called for an "affordable" capable of carrying a payload of 5,000 lb. for 200 mi. or 2,400 lb. for 750 mi. were issued to Lockheed, Sikorsky and Vertol.

Both the Sikorsky S-61, a twin-engine single seat aircraft, and the 127 seat freighter to Air Force, Texas, Tennessee, and members of the U.S. East Coast as part of the Air Force system.

An FMS team headed there HS-61, the military component of the S-61, for a proposal to Texas, Texas, for a new aircraft last March. There will be 48 aircraft in the first flight contract until 1982 delivery can begin. No contract has yet been written with Vertol and no first delivery date set. Vertol 147 reworking capability was a major factor in the choice (AW Mar. 7, p. 6).

For budget purposes the SOR 190 contract was temporarily designated the HS-61. The 107 capable of carrying 25 troops or 15 litter patients and two stretcher patients weighs 19,000 lb. Gross length is 44 ft. 7 in. and the rates of climb are 365 mph.

A water-hauling half will possess the 207 to land on relatively solid water. The question which put from the lower part of the fuselage provide stability to prevent capsizing while on the water. They are anticipated to provide lift during forward flight.

Power for the 107 is furnished by two General Electric T70-GE-1B gas turbine, power output engine, each producing 1,290 shp. Gas generator type is 26,200, and power takeoff speed is 19,930 rpm.

No price has been announced. Sunk cost recovery factors have cost between \$300,000 and \$400,000, depending on equipment. The aircraft purchased will be off-the-shelf models.



JACKING OPERATION The loading cranes are disconnected by the Sikorsky S-64 Skycrane. The hydraulic fluid has been pumped out of the main jacking gear cylinders, lowering the Intermecan 8 m, for attachment of the pallet holding empty oil drums.



PALLET SECURED. Bush is passed back into the gun cylinder. The pallet now is clear of the gunnel, permitting the loaded S-64 to fire or to make a running reload. Right-hand travel of the gun also can become an emergency stoppage device or load holding through capture of a hydraulic line. Bushlike structure behind cockpit houses fuel redistribution.



UNLOADING OF THE PALLET is residue of the loading operation. Here the pallet is being lowered with the S-54 still in the "down" position. Second S-54, with truck trailer load attached, is in background. It is one of two for West Germany.



ANTENNA An experimental radio reflector AM-1000 manufactured by Electroni-Antenna Corp. extends below some of the S440 height. Designed to give the craft operator a precise indication of how much cable to pay out, the device is strung to 25 ft. Production version will have antenna reduced to prevent flashover. Photo caps on landing gear strut (left) are calibrated for scaling by double lead levels. Gear travel is 5 in. for the podding operators.



Skycrane Demonstrates Lift Capabilities

Dr. William H. Gassaway

Statland, Conn.—Sikorsky Aircraft Corp. formally unveiled its twin-turbine S-64 Skycrane to potential civil and military customers last week, demonstrating both single and two-copter hover, as well as climb low altitude 800 ft/min and landing.

The *deutschnazisierung* heingezogen, which had flown a total of 3 hr prior to the display, as Stoerz's own aircraft. A second Sa41, due for delivery to West Germany in December, was on static display. Stoerz is building another Sa41, also ordered in, the Germans for delivery sometime (AW Dec 23 p 18).

Selosky plans a 10-hr flight test program that will require the set of data just to complete, and the West Coasters are planning a 25-hr program. The German helicopters also will be evaluated by France and Italy.

U.S. Arms received as reported, and an order for three 500-lb. tons be provided with Picard 1905 bands. Law 5

1980s were taken 1980-1981. Mr. A. Johnson, Sikorsky principal manager said that Department of Defense had shown interest in the concept but had no good priorities for funds to other types and sizes of helicopters.

Unit cost of the S-66 was reported by Johnson at approximately \$2 million, but possibly dropping to \$1 million in quantity production.

West Germany has indicated it would like to move into the 20-ton payload category—the Russian *Vostok* flying crane has set a 16.5-ton world lifting record—rather than the 10-ton category of the

S-64 But S-64 is preparing a real. We S-64 to perform the same mission to avoid the relatively long deployment time to move into higher altitude. Coupled load carrying aircraft would be required to accomplish a light upgrade for the load and extension of a fuel at each end to each of the helicopters.

Development of a 55-passenger pod for the S64 is under way and will be completed by 1997. Passengers will be seated in an aisle. There is either side of a central aisle and the pod, assembled inside the basic frame, will be suspended on hydraulic points to act as a deckhouse.

No Federal Aviation Agency notification program is planned currently, and formal applications are expected to be in military and government programs. Some of these proposed include anti-tamper and anti-theft waiver as a single instance at a limited rate and as a

At a commercial passenger vehicle, the 8-61 would have had direct operating costs of 14-16 cents per seat mile on 100,000-mile stage lengths or in range of 15-20 cents per seat mile.

Test instrumentation is mounted in a low-profile structure, behind the cockpit. It includes an inclinometer and a photo panel comprising 180 instruments for monitoring stresses, powerplant performance, stability and control. The Vortec instrumentation is concentrated on the dynamic measurements.

U.S.-Funded Military Research Abroad Will Be Unified by DOD

Washington—Defense Department is planning to study all basic research sponsored by the U.S. military services outside the U.S. First move was revealed last week with the announcement that a Defense Research Office will be opened July 8 in Rio de Janeiro, Brazil.

The new South American office will coordinate the military research program throughout Latin America by contracting with countries for exclusively basic research. It will also arrange for exchange of information and visits of U.S. and Latin American scientists with similar research interests.

Finally, the costs are expected to increase to \$180,000. In another year the expenditures are planned to reach \$1 million.

Press Details

Withington—Additional detail on the new Fenne Optimal Satellite Surveillance system (FOSS), to be developed by Radio Corp. of America for USAF's Electronic Systems Division, have been released by the Air Force with the announcement of a \$21-million contract award to the corporation.

The system, expected to have a range many times that of radar against small targets like the size of satellites and space vehicles, will employ a high-power wide-angle telescope, an extremely sensitive image intensifier tube with a matrix of photo-sensitive cells and data processing equipment for storage and analysis of the areas under surveillance.

Image of star, which receives food or spins, will be counted out automatically to permit rapid detection of any moving object, a minute or an hour. The image software is so sensitive that it would be disrupted if the telescope were moved at the same time. Automatic controls will prevent the telescope from viewing the sun or moon. The prototype equipment, slated for delivery in 1964, will be installed on a satellite top in New Mexico for evaluation tests.

C-141 Engine Tests

East Hartford, Conn.

Military qualification of the 11.7-litre engine is expected by June 12, according to USAF.

The C-HI™ engine will incorporate standard one-lap shooting (10W June 4 HI) and two-length shooting for the open-class Medals at the front.

— 1 —

15. Falls to Ashby

X-15 Fails to Achieve Programmed Altitude

Los Angeles—Planned peak altitude of 162,000 ft was missed by 35,000 ft in a flight by North American's *xa*

ber 2 X-13 to check the stability of the experimental aircraft at a higher angle of attack than it had yet achieved.

Burning time of the Thielert XLR 9 rocket engine was 91 sec instead of the planned 95 sec. This contributed to the failure of the XE5 to reach its planned altitude. At the planned climb angle of the 57,000 ft/s thrust engine is sufficient to accelerate the airplane at about 100 mph per sec, so because velocity should have been about 250 mph more than the 3,700 mph needed

What was obtained is an angle of attack of about 21 deg, shortly after burnout at an altitude of 59,800 ft and was subjected to g_2 during the maneuver. The precise maximum angle of attack will not be known until data tapes are analyzed. The highest previous angle of attack, Brown was 18 deg. NASA flight research center engineers plan to test the X-15 at gradually increasing angles of attack to a maximum of about 25 deg.

The soft element of auxiliary struts' augmentation system also was recorded successfully twice during the flight.



new achievements in protection for inertial guidance systems

Today's inertial guidance systems are engineering triumphs. ■ Maintaining their on-target accuracy in adverse environments requires a similar triumph. This ranks as the most demanding, most sophisticated challenge in vibration/shock/acceleration control. ■ Lord has met this challenge. Electrostatic suspensions have been engineered to assure reliability for our nation's foremost weapon systems: Atlas, Titan I and II, Polaris, Hound Dog, Skybolt, Centaur, X-15, submarines and surface ships. And, Lord systems also protect guidance computers on Atlas, Pershing and Centaur. ■ Now under development at Lord are even more sophisticated systems to protect the next generation of inertial navigators. This explains in part why you can expect more from Lord when you have to protect sensitive equipment. Counter Lord Manufacturing Company, Erie, Pa. Field Engineering Offices in principal cities. In Canada: Balshaw & Power Engineers Com., Ltd.



THEY WATCHED THE FIRST DOG FIGHT

LEACH HERITAGE OF THE AIR - 80

From the French soldiers, then the Germans, dashed out of their trenches in surprise at what seemed sight. On this morning of October 3, 1914, they watched two airplanes in mortal combat—the first dogfight in the history of aerial warfare.

The French craft, a Voisin biplane, was recovering from a mission. Stayput had landed his over the village of Longueval, near Bapaume. Sergeant Joseph Frantz quoted a German Aviatik, before long. It was heading East toward enemy lines.

With a nod to Captain Quenault, his observer and machine gun-

ner, Frantz banked into a steep dive, cut off the German's flight path, and forced him to turn back. Thus the shooting started. Quenault began firing point-blank at the surprised Aviatik. But because his Hotchkiss machine gun was of the semi-automatic type and often jammed, he could only get off one shot at a time. Even then the leaping Voisin had the advantage. Its machine gun was mounted in front of the pulsing engine, so it could fire straight ahead at an enemy. But since simultaneous firing through the propeller was not yet developed, the Aviatik could

fire only to the sides and to the rear above its tail.

The German pilot, Sergeant Willy Schlichting, tried desperately to turn and turn out of Quenault's range. But Frantz kept his Voisin right behind the Aviatik's tail. And when all seemed lost, came the German's fire. By then, the two planes were a mere 400 feet apart above the rolling French hills.

All this time, French soldiers, cowered with the mud of the trenches, cheered on their countrymen. Quenault had responded with a total of 57 rounds—most of them hits. Then, all of a sudden, the Hotchkiss jammed. It looked like the war's first dogfight had ended. But seconds later, the Aviatik flipped upside down, spewed out a cloud of burning gasoline, flamed and dropped like a dead weight straight into the ground.

In less than 30 minutes, the war's first dogfight was over. And a whole new chapter in aerial warfare had begun.

Joseph Frantz was decorated with the Knight's Cross of the Legion of Honor, and Quenault was awarded the Military Medal. (Throughout World War I, the pilot of a two-seater aircraft nearly always got the higher honor even when his observer made the kill.)

Joseph Frantz learned to fly in 1909, when he was 26 years old. He became France's 383rd licensed pilot in February, 1911 and set a world record for sustained flight (14 hours, 27 minutes) in a two-passenger plane. He joined the French Air Service in 1912. He was a member of Squadron 24 at the time of his historic

The plane he was flying was then Isotta Fraschini, also held a sustained flight record. The Voisin could travel at 2000 feet for five hours.

It was powered by a 135 hp. Salmson pusher engine mounted between the wings and facing the rear. Machine gunners used cloth bags to keep spent cartridges from flying back into the propeller blades. Both Frantz and Quenault are still alive today in France. Frantz lives in a small Paris apartment, and still flies about 250 hours a year. Without a second job.

Heritage of the Air

One of the most inspiring chapters in the history of aeronautical evolution is the story of the men and flying machines of World War I. It is the highly personal and story of heroic men—and the road, wire, heat and meteorology technologies that conspired to empower them. Today, Leach Corporation observes its 40th year in electronics with the presentation of this *Heritage of the Air* series.

★ ★ ★

President Director for *Heritage of the Air*
Dr. Lt. Col. Klaesburgh S. Brown, USAF



...the propeller airplane with 1000+ EIFFI Depressor boost, a great helper in other applications. In the art of 20th communications in recording obnoxious steel elevators by the power of one's concealed talents in the diligent community of space, sort of Pasadena.

LOOK TO LEACH

LEACH CORPORATION, 23105 Watson Road, Cypress, California
Export: Leach International S.A.

Most Large Contractors in AIA Cancel AFA Convention Exhibits

Washington—Most major contractors who belong to the Aerospace Industries Assn. have followed association policies which restrict participation in defense products exhibitions by canceling planned exhibits at the Air Force Association convention at Las Vegas, Nev., Sept. 15-19.

Out of 47 spaces reserved on an AIA waiver, only 13 companies have stated that they will construct fair exhibits there, Las Vegas.

Among the companies that have decided not to participate are the Aerospace Division of Ford Motor Co., Aerospace Corp., Avco Corp., The Boeing Co., Douglas Aircraft Corp., McDonnell Douglas Corp., General Motors Corp., Allis-Chalmers of General Motors Corp., Goodyear Aircraft Corp., Ling-Temco-Vought, Learjet Corp., Rockwell International Corp., United Aircraft Corp., and Westinghouse Electric Corp.

Reason by AIA

There are no restrictions imposed on industry by law or Defense Department regulation on spending funds for corporate exhibits at the AIA convention, which applies to exhibits in 35-3551, which, on the subject of advertising costs, specifically prohibits defense contractor funds from being used for this purpose under terms of subcontract or long-term contracts for producing or展示ing fair exhibits.

In announcing the results, Defense Department said that negotiations with contractors interested in performing Logistic services still were under way. It was apparent, however, that a sizable portion of the new Logistic contracts will go to the carrier that negotiates the lowest AW 610 Awarded flighted backlog. James Robbie Airlines is their British counterpart, a small British airline.

AIA went a step further, however. A resolution passed last year and re-enacted both at Washington and the AIA public relations meeting at Phoenix, Ariz., called that year displayed the multiplicity of exhibitions which caused diversion of money and effort from more important purposes.

Unsuccessful AIA members that participated in exhibits in the U.S. or were ordered by the AIA or formally requested by Defense at the National Aerospace and Space Adm. demonstration be eliminated as exhibitors in the maximum extent possible.

Policy Implementation

Implementation of the AIA policy in the case of the AIA convention was aided by the shrinking number of defense contractors that have AIA waivers. Most discontinued their waiver preference to exhibit their hands in violation of company rules, such as a result, little use of waivers can now be observed, NASA said.

The performance of DSO-1 was "near perfect" until May 22, the agency said, and the data it transmitted will lead to better understanding of solar radiation and solar energy. An attempt will be made to launch DSO-1 early next year.

Of the companies participating in the

AIA convention, some were so deeply concerned that they would have been in many ways spent on exhibits and possibly concerned for contract cancellation if the decision had not been made.

Some fair exhibitors have told the AIA that the "customer" in association needs their limited support. This applies to the AIA, Navy League and Army of the U.S. Army.

AF Airlift Contracts Valued at \$96 Million

Washington—Military Air Transport Service has awarded 11 contracts to airframe worth \$96.3 million in fiscal 1961—the largest single award in its history in Air Force history (AW May 21, p. 52).

Contractor contracts aggregated \$85,710,000 of the total, a substantial increase over the \$44.4 million MATS awarded at the end of fiscal 1962. The remaining \$7,715,000 goes to Stark Airline, Inc., operating under Quonset Valley's domestic air freight service.

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The space agency indicated the intent is to spin up to a point where the servo system could no longer control the attitude instruments and solar cells toward the sun, the space agency said. In attempting to do so, the same system using large quantities of power, the battery is continually draining the battery in a continually decreasing state, such as a result, little use of waivers can now be observed, NASA said.

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Of the companies participating in the

U.S., Russia to Share Weather Satellite Data

Government and the Soviet Union will share data received from their respective weather satellites and possibly conduct launch data and mission alignment as a first step toward a potentially broad space research program.

Under terms of a just signed agreement, the two nations will make available to one another information received from weather satellite probes and hopefully produce timely objectives to measure overlaps in the areas of exploration. Agreement also will extend to the launching of research satellites for the study of the earth's atmosphere and ionospheric fields. No precise terms were made, however, as to just how much of either weather satellite data will be exchanged.

To implement the agreement, U.S. officials hope joint data centers can be established at both Moscow and Washington. Data obtained also will be made available to all other interested nations.

A U.S. spokesman said last week that, if successfully implemented, the program will "help out our own substantially since we won't have to repeat one another."

The talks, which grew out of negotiations within the United Nations Committee on the Peaceful Use of Outer Space, originally began in Washington and will now shift to Moscow where issues involving spheres of responsibility may be agreed upon. U.S. delegation was headed by Dr. Hugh L. Dryden, deputy director of the National Aeronautics and Space Administration. The Russian group was headed by Soviet Ambassador Anatoli Dobrynin.

A wider ranging pact on joint weather exploration activities also is expected to be concluded during discussions between heads of the World Meteorological Organization, including increased cooperation in the trademark fields of weather forecasting. A final report by the organization is expected sometime this week.

Northwest Airlines, \$2,050,101, and

Overseas National Airways, \$1,212,614.

In all, the MATS will grant an additional \$1,000,000 to 109 other contractors, bringing 23.9% more of military cargo and 17,460 more tons of military loads. MATS also has 254,478 passengers, 6,790 tons of cargo and 2,880 tons of mail. MATS will be moved to the Air Force in 1963.

About 140,000 passengers, 14,180 tons of cargo and 1,580 tons of mail traffic will be moved in the future.

The balance represents Alaska air traffic.

Lunar Mission Time

Lower stay time on Apollo missions probably will be seven days, according to Charles Fink, Apollo project manager for the National Aeronautics and Space Administration. Earlier reports had indicated that the stay would probably be limited to 24 hr by high temperatures on the side of the moon exposed to the sun.

Truck and NASA are giving strong new indications to leading users now the Soviet rocket is the last of orbiter vehicles that is in the direct light of the sun. Earth time is expected to be three or four times as long in sunlight observed on the earth.

Lifting off of Apollo capsule is due to 10 to 15 hr lifting-off time planned to give astronauts some control of the truck to inspect. Apollo lifting-off time is nearly four times that of Gemini.

Bell's Corp.'s Radio Division will

under what National Aeronautics and Space Administration staff believe is the first mandatory incentive contract ever awarded for performance in service-type work. Bell's has been operating the stations since last July under a standard contract. Eight firms bid for the new two-year contract, which will become effective next Jan. 1.

Air Force last week cleared the world's estimated data, electronic data stored for a B-52B after a few years from Seymour Johnson AFB, N.C., 11,367 mi. via Honolulu, Guatemala, Manila and Los Angeles. Earnings record of 18,000 hr was set in 1960 by a B-52.

NASA-North American X-38 First Thursday accomplished nearly a 90 deg turn, the largest deviation from a straight line since yet made by the X-38.

Second flight test of the USAF Martin X-38 mobile payload airframe-aerostat/hab module made over the Altitude Module Range June 7 was called partly successful by the Air Force. First flight, the successful, was made last May 16 (AW May 26, p. 24). After second stage ignition, telemetry indicated that the module failed to reach its target of 40,000 ft.

Airline Transportation Tax Reduction From 18% to 5% effective Jan. 1 was approved last week by the House. The measure does not provide that original thought by President Kennedy to finance operation of the federal airways.

MA-7 Overshoot

Washington—The end of 25 deg to the right not far in entry was largely responsible for the Apollo 11 stay time landing 200 mi. west beyond its expected impact point after May 26. Col. Scott Carpenter's three-and-a-half-day MA-7 flight May 26-28 June 4, p. 261, the National Aeronautics and Space Administration said last week.

As a result, the threat of the overshoot was avoided as an acute, rather than a marginal, threat for the next MA-7 flight. The MA-7 flight's overshoot was caused by the centerline overshoot at an altitude more shallow than planned. This was caused by nearly 180 road out of the crew sheet, NASA said.

Retirement Almost 150 less than normal accounted for another 40 hr stay, and the balance was due to the failure of the retrograde system about 3 sec late, the agency said.

A NASA spokesman said the capsule's park stability was probably just prior to entry.

way and it will revert to status as a BOAC flight. For instance, a London to New York flight would be identified as BOAC-Contair and similar to BOAC flights would be associated with BOAC-Contair. If the flight continued from New York to the West Coast, it would be Pan Am, however, that segment would remain BOAC's original assignment.

BOAC-Contair will also be able to buy additional 707s, three more, as well as extra options with BOAC-707 and DC-10. Between 312 aircraft from BOAC to increase scheduled services or charter, if required.

The BOAC-Contair route network will include all of BOAC's existing 707, Bostons and DC-10 routes within the areas assigned to the new company, and will also encompass Pan Am's 707s.

Others of BOAC and Contair will be sure to link with the flight crew and maintenance body issues in

"Cathayman" flights moving London, Brussels, Mexico and Japan with a connection to Managua.

Contair flight's 707 flight and other areas have been given the option of transferring to BOAC if they want, no further operation with the joint venture.

BOAC's management committee of the two Central Europe 707s, boasting an expansion from 36 to 15 aircraft, as a result of about 121 percent in unmet demand. Since this will reduce services at Central Eagle Airlines have made additional plans for future services.

Other areas of the agreement to form the new company will include its registered office at London Airport, the two companies

propose to shift compensating maintenance services for BOAC DC-10s and DC-10s to Central Eagle.

• **VIC 39** and Super VC 10 jet transports will eventually supplement BOAC's 707s on the BOAC-Contair transatlantic routes.

• **Flight year** for BOAC-Contair will be April 1 to May 31, the same as BOAC.

• **BOAC-Contair** will be entitled to make full use of BOAC and Contair aircraft and advertising slogan on promotion of the new carrier's aircraft.

Anti-Carroll Forces Swing ALPA Election

By David H. Hoffman

More Beach-Dickinson candidate Charles Rabe of National Airlines, with the sudden support of even pilots who opposed Jack Carroll as president at the last ALPA convention, was a sure bet to become the third chief executive in the union's 31-year history.

Even pilots with BOAC's experience during last 25 years and the flight safety record of the last 10 years before they appeared to be more or less divided, however, between the radical Carroll's vote and the smooth of pilot-management problems within that airline.

To illustrate a gloomy future segment of the airline's labor history—Northwest, Delta, Continental, Braniff, National and United—was through pilots, Rabe, Bill Pen American, Eastern, American and Trans World—had a plus. In addition, and which certainly set ALPA's bargaining pace—confirmed Carroll with equal vigor in did Southwest.

Seven Steps Down

Until the following began on the morning of the meeting's start with due, there were many here who will be heard that outgoing President Charles N. Stein would remain in office. As it was, Stein's support faded to nothing as the members he supported were elected, but he refused to step down on orders. His strong personal feelings that ALPA's fate was president, from the cockpit was manifested to the point.

Of 13,723 votes cast at the head of division meeting, 7,617 were for Capt. Rabe, and 6,166 were for Capt. Carroll. But Rabe's margin of victory was far greater than the final figure suggest.

Joining Carroll with the ALPA faction that favors a loose affiliation with other unions were from the union's Steward and Stewards Division.

Electors of ALPA's president take a plus in that they support the plan to have the S. & S. Division return again after three years. However, under the ALPA constitution, the plan can expect the S. & S. Division from the union's top by a two-thirds majority and the first proposal of Carroll's was defeated.

There was little question, therefore, that the S. & S. Division's using its vote to veto the pilot's choice for president. All of the other unions—with the exception of seven male partners—voted for Rabe, and the 1,361 votes for him.

This was not interpreted to mean that the S. & S. Division would not be allowed to do so and remain in union with ALPA. On the contrary, most business identi-



CHARLES RABE

fied Carroll with the ALPA faction that favors a loose affiliation with other unions at the time. In addition, however, they placed in the big majority that backed Carroll as represented by other unions.

Veterans' Plan

Capt. Rabe, S. & S. president (National) in 1975 and he holds the third chair on an executive committee. The last ALPA president, the National, was nominated under Carroll's direction and was elected chairman of the executive. His election to Executive Council in 1976. The 90-year Rabe was National's chief pilot. In the election he defeated Doug Dugan from Stowes to Los Angeles and San Francisco.

He has promised to serve all committee with his entire in a result of the election.

On the subject of retaining a majority another Rabe and Carroll were in sharp disagreement, with the latter agreeing that an ALPA president, in order to retain absolute with industrial problems concerning the union, should not come from Carroll. Carroll also favored limiting the ALPA president's term to two years instead of the present four.

On the 11 pilot letters mailed to the division four weeks before the election (S. & S. May 15), seven said they "would support" Carroll to continue as chief executive, every two years, while ALPA would function as a continual training school for another position. His staff would work without direction and its organization would disorder in that eventuality, he told the delegates.

According to Rabe, neither the president nor the executive administrator of the union should hold on to active assembly members. "The pilots," he said, "must have the assurance that

they can leave the union's" appeal of work. Carroll. No later problems are anticipated a BOAC splitover will be seen, because the company and Central Eagle Airlines have made identical plans for future services.

Other areas of the agreement to form the new company will include its registered office at London Airport, the two companies

propose to shift compensating maintenance services for BOAC DC-10s and DC-10s to Central Eagle.

Trunkline Pilot Vote

	Rabe	Carroll
America	9	1,294
East	462	1
Capitol	782	9
Continental	268	9
Delta	451	9
Eastern	256	1,065
National	329	0
Northwest	0	281
Southwest	496	0
Twa World	1	1,291
United	1,163	284
Western	36	222
Plus Associate	418	619
	6,713	8,208

Int'l opposed Carroll also opposed the early election. The count: 6,565 for, 3,755 against.

At the election got under way June 3, first of a complicated series of events from the floor was made to make McMenamy eligible to be the president. Formerly a United pilot, McMenamy had resigned from the union to enter private aviation before he was elected executive administrator and it was ruled that only a two-thirds majority of the membership could award him a place as his ballot.

McMenamy's campaign was brought to a sudden end by a roll call vote in which 6,177 pilots backed his candidacy but 6,039 opposed it.

Caught actually off balance, United pilots moved for a 30-min recess but American and TWA delegates used a form of motion and points of order to end the debate during the time. Rabe's motion passed to end the discussion by the remaining committee and was ended.

Both Rabe and Carroll followed.

As delegate who delegate moved to the nonmembers to avoid the nomination of Rabe, the strategy of the anti-Carroll forces could also focus. First, there was an impression that McMenamy endorsed Rabe in the race and would continue to work for ALPA if Rabe was elected. Then, Butler addressed the convention.

"Disturbing forces" at work within the association had prompted his switch.

French Alter 707

Paris—Air Force test pilots last week to adopt new control settings techniques during roll to reduce the risk of Boeing 707's following the cockpit. The first of a Boeing 707-325 Intercontinental at Orly Airport killing 138 passengers.

A delegation from the directors of flying personnel to all pilots and captains and that the airplane reached a speed of 180-190 km/h without leaving the ground and that an aircraft control roll maneuver can be considered as a cause. It is possible that the aircraft was passed on an extreme nose-down position.

The delegation of flying personnel to follow three take-off procedures.

- After testing control surfaces, check that there is no load spot or uneven in elevator or pitch roll.
- Up to 40 km/h, on roll-off roll, the elevator is pushed the control column forward to a midpoint between neutral and maximum forward three to keep the nosewheel on the ground and the weight on the proper attitude.
- At 40 km/h, pitch take-off roll over clear for control roll should feel progressive resistance as it moves the control column up.

If the aircraft attitude is lost at 180 km/h, the take-off should be aborted.

After the meeting from the men, Rabe argued his supporters to switch to Rabe. The first roll followed and minutes later Rabe had adjourned the meeting for lunch.

Following ALPA's one roll, Northwest, National, Capitol, Continental, Braniff, Delta, Eastern, Caribbean, American, Northwest, Central, Allegheny, Lake Central, United, Pacific and Alaska pilot association, plus TWA, American, Shick, Trans-Tropic, Hawaiian, Central, Pan American, Western, Pan Am, Northwest, New Air Service, and Capitol were equally strong for Carroll.

"Some of our first flight I'd resign," was Stein's last words as ALPA president. He left the office he assumed in 1951 with a new white convertible, right hand the plates. He also left with a job as ALPA consultant at a salary equal to his daily earnings as president for a rideable period.

After the election, Capt. Richard O'Neil, Northwest, went to the office of ALPA first president by leaving Capt. Charles McMenamy. June 5, 1957, Capt. S. G. Gonick of McMenamy acknowledged the incoming Capt. Paul At. Los of America, 6,905 to 6,195, for the office of secretary. Capt. S. J. Davies of United was elected secretary over Capt. Jerry Schmid of TWA in a tie. Capt. John 7,370 to 7,076. And heretofore Delwin Koller of Northwest was elected the first president of ALPA's new S & S Division.

French Alter 707 Takeoff Checks

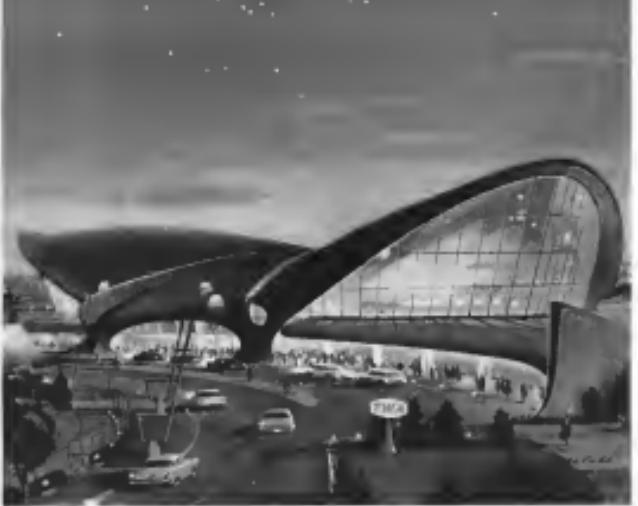
The aircraft disaster flight on route to Paris from New York, about 100 of the 300 in the East-West sector, disengaged and landed, losing 138 of the 267 of the plane over the last 60 km of the paved surface. Preferred takeoff point was at the end of the runway.

Some witnesses also reported hearing a change in the pitch of the engine noise as though the pilot had lost in their steers in an effort to lift the aircraft's roll. Others testified that they detected no such change.

The average takeoff weight was 301,587 lb to 4,142 lb below the allowed maximum—including about 140,000 lb of fuel for the transatlantic flight. It had returned to Orly from New York on June 2 and had undergone a 100 hr in check at that time. No defects were reported. Flight began with the last major overhauled were reconditioned at 315. Total flight time on the aircraft from the time of its release in September, 1969, was 4,491 hr.

The four Pratt & Whitney JT4A-9 engines had total engine times of 3,141, 1,199, 1,189, and 1,501 hr, respectively. Takeoff temperature was 58°.

The new TWA Trans World Flight Center at New York International Airport



"TO EXPRESS THE EXCITEMENT OF TRAVEL"

...EERO SAARINEN

This is the new Trans World Flight Center in New York. Architect Saarinen designed it to express the special excitement of jet travel. Its soaring roof and sweep of glass exudes a hundred new ideas to speed your departure and arrival—like TWA's fast new jet check-in and boarding, and automatic bag-gage delivery. International shops are here. Comfortable lounge. Classrooms, restaurants. One other fact makes the Trans World Flight Center entirely unique: it's the only airbase terminal where routes from 90 cities in the U.S. are linked to routes in Europe, Africa, and Asia. One world under one roof.



Pilots Take Tougher Noise Stand, Define Unacceptable Maneuvers

Most Boeing-747 Line Pilots Assn has hardened its stand against any noise procedures involving dangerous low flying techniques and defined those techniques it considers marginal.

In a formal policy pronouncement here, the union's board of directors put ALPA's full weight behind an eight-point program just developed by its committee on aircraft noise. (See committee ALPA, 7, p. 18). Under the new slogan, ALPA is committed to "reject any statement procedure that endangers any of the following:

- Clashes in communication or change heading at low altitude
- Turns below 600 ft. solely for noise abatement purposes
- Rudder or pitch trim that cannot power maintain on takeoff
- Clashes or loss from maneuvering speed for the avoidance of flap configuration
- Approach to runway from the Instrument Landing System glide path
- Autorotation procedure in weather where there is a 1,000 ft. ceiling and 5 sec. visibility.
- Radio calling during takeoff and approach for other than ATC purposes
- Post-turbulence recovery controls that can be followed in wet weather, or with crosswinds greater than 10 ft.

The noise abatement procedure in use at New York's Idlewild Airport would be rejected if it caused unnecessary waste of three flight segments.

According to ALPA's policy resolution, "noise must be reduced by engineering and design and not by marginally safe flying techniques." It indicated that such techniques became marginal when any of the eight points were breached by airport operation, airline management or the Federal Aviation Agency.

Timing of the resolution's passage coincided with ALPA's annual meeting of two years ago, held in New York on March 31 and April 1 under APC's sponsorship to discuss the issue question. During those sessions, FAA Assistant Administrator Oscar Brink said that the agency had come "very close to evaluating the technical possibilities for silent noise."

Speaking before an audience of pilots, airline officials, political leaders of surrounding communities and representatives of the Port of New York Authority—which operates Idlewild—Brink held out "very little language hope" for the outcome of the two-year project in the New York area.

Tracing what he described as a moral-legal dilemma, Brink said that the criteria of consumer safety surrounding air transportation "But at the same

time that commercial aircraft are trying to bring more aircraft closer to a city, those who live around it are generating counter-pressure to keep the aircraft at a distance.

FAA officials present at the meeting indicated they were willing to compromise on some of the pilots' points, but not all. "For example, the 'no flap' provision—'no flap' means no low altitude flying, no turn radius to 200 deg. is as long as given to pilots during runway 31L at Idlewild. But the fact itself means potential problems despite pilot objection."

Top Officials Chart Anti-Bomb Measures

Washington—After U.S. efforts to reduce the international threat of terrorism will be charted by a high-level steering committee, which can last two to three years, to review past progress and to discuss the possibility of placing signal-encoding chemicals in explosives.

Members of the committee, which has an formal title as yet, include N. E. Hulme, Federal Aviation Agency administrator; Courtney Evans, director of the FBI's special investigation unit; Alan Head, chairman of Civil Aviation Board; Nicholas Rathbun, chairman of the U.S. Civil Aviation Safety Board; John L. Lehrer, director of the Flight Safety Foundation; Dr. Glenn T. Seaborg, chairman of the Atomic Energy Commission; and Stuart Taylor, president of the Air Transport Assn.

FAA and AEC have been conducting research on the bomb scare problem since 1960. In fiscal 1962, FAA allocated \$45,100 to research being carried out at Catholic University here under APC's sponsorship. During 1963 and 1964, APC and FAA each allocated a total of \$750,000 for explosive research and on its share of the APC's own programs. Further allocations will be made in fiscal 1964.

Although APC is heavily involved in the program, as an APC spokesman said, the so-called signal-encoding chemicals under study need not be radioactive. Other techniques that could show promise in preventing explosion involve X-ray use, fluorescence inspection, magnetic detection by neutron capture, explosive detection by neutron capture, explosive detection by infrared and radio wave detection, and other methods described above.

Neither FAA nor APC intends to publicize the jointly-funded program, for perhaps they believe that doing so may erode the type of psychosis likely to subvert an aircraft.

In a related development, Sen. George Smathers (D-Fla.) has introduced a bill in the Senate to amend an amendment that can be purchased without interview or physical examination to \$10,000 to lessen the bomb problem. He said that "the amendment and case with which it is possible to obtain a \$1 million dollar bomb of flight instrument for a few dollars will be a factor in the discounted land of persons who would seek to destroy a plane by bombing."

JAL Domestic Profit Eases Overseas Loss

Tokyo—Revenues from Japan Air Lines' domestic network, bolstered by the introduction of Convair 880 jet service to Osaka, managed to offset financial losses sustained over the past year international routes to the U.S. and Europe to provide an overall net profit of \$316,284 for the fiscal 2068 year ending Mar. 31.

After recording a net decline from \$1,625,272 net earnings reported during the previous year, the lower profit margin was attributed to three main factors by JAL President Shunroku Matsuo at the stockholders' meeting here.

• Added competition on international routes as a result of increased passenger capacity through the continued introduction of jet aircraft by the major carriers on the route under separate to the U.S. and Europe.

• Tightened foreign currency controls by the Japanese government which sharply curtailed travel by Japanese businesses and tourists to foreign countries.

• U.S. government's anti-global "Fly American" campaign, a re-enforcing factor amid by many foreign carriers competing with U.S. international airlines for U.S. passengers.

While no specific figures were given, JAL officials said the relatively high load factors on domestic routes in response to those maintained on international routes accounted for the airline's fiscal 1961 showing in the black. Matsuo told the stockholders' meeting that total revenues amounted to \$69,562,561, a 38.3% increase over the previous year's \$50,018,078. Total expenditures rose from \$50,965,806 to \$69,532,617.

To improve its international and domestic route structures, including projected new schedules to the Middle East and Europe, the airline also is considering purchasing aircraft or lease of 100 new aircraft from General Dynamics' Fokker division. In addition, the San Francisco medium range jet transport and the long range Douglas DC-8. A Japanese government guaranteed \$5.5-million loan base for this purpose is now available (AW May 14, p. 58).



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SHORTLINES

► **Allegro Airlines** had a net profit of \$46,772 for the month of April, 1962, on a total of 577 revenue passengers with a \$402,311 loss on revenue of \$5.9 million for the same period last year. The profit is the first for a comparable period since 1949.

► **South Airways** and Pan American World Airways will begin transoceanic service connecting Bremen and Dusseldorf with London and Frankfurt, via Chicago. The services will use 707 jet equipment under a recently approved equipment interexchange agreement.

► **Federal Aviation Agency** has extended for one year a rule prohibiting passenger use of portable FM radio in all U.S. commercial aircraft. Also extended was a rule prohibiting portable FM use on any civil aircraft while VHF radio equipment is in operation. FAA originally adopted the rule on May 25, 1961, after test indicated FM use adversely affected VHF radio operation.

► **International Air Transport Association** has been forced to increase fuel and maintenance and airfares charges for the world's scheduled air services as increasing taxes as fast as traffic. IATA estimates scheduled carriers now pay \$193 million annually in charges—a 75% increase over four years ago.

► **Japan Air Lines** will extend its Tokyo-Hong Kong/Singapore route to Djakarta, Indonesia June 15. The route will operate Convair 990s on each of the route to Djakarta Monday, Wednesday and Friday.

► **Shick Airways** has reduced two additional CL-44 turboprop aircraft from Canada for delivery this fall. Value of the aircraft is about \$9 million.

► **Tenne-Tenn Airways** has begun contract services with DC-9 5 equipment in four aircraft seating configuration at fare discounts up to 30%. Tenne-Tenn are the new firm are effective 24 hr. daily, using 12 seats a day on approximately two-thirds of its total flights.

► **U.S. certified air carrier** interface banner for April, as reflected in Airline Carrier Human Information, totalled \$16.6 million, compared with \$18.3 million in April, 1961. Interface banner total for last four months of Feb. 2 was \$56.6 million, as against \$51.5 million for the same period last year, according to Air Transport Area Experts.

AIRLINE OBSERVER

► **Watch for Civil Aeronautics Board** to bring the clause Howard Hughes is using at a witness in the New York Florida Route Revision Case. Charters are strong. The Board will refuse to renew Northeast's Florida entitlement unless Hughes himself transfers it to the port of Miami, where he is served only. Hughes reveals his intent to sue for the service in the Miami Twa Co. control of Northeast is given final approval. Failure of Hughes to notify us in the Hughes Twa Northeast Control Case evoked some industry criticism of the Board's proceedings.

► **U.S.** is showing increasing concern over steady expansion of Aeroflot routes into Africa and over the Soviet airline's plans to extend these routes to South America. Latent African operations in between Moscow and Khartoum, capital of the Sudan Republic. Proving flights on the route are now being conducted in the Russian carrier.

► **Fresh government conference** to drag its feet on final approval of Air Union, despite plan by Air France for a positive decision. Three other governments concerned—Belgium, Italy and West Germany—have indicated their approval of the joint airline. France's position is complicated by the recent resignation of its transport minister, as well as by reluctance of the de Gaulle government to cede into a European concentration. Current involved—Air France, Alitalia, Lufthansa and Sabena—approved the plan one year ago.

► **U.S. airlines**, after winning strongly qualified Federal Aviation Agency permission to land their jets in 100 ft. ceiling, 4 mi. visibility weather (AW May 22, p. 42), and laying the groundwork to get full landing clearance of 100 ft. and 1 mi., The Association of American Airlines now believes that "200 and 4" no longer poses a technical problem, so much so that the committee is concentrating on the Instrument Landing System and runway lighting improvements that might merit 100 and 1. First action to apply for minimum lower than these new set for both jets and piston-powered aircraft could be United, which is examining new instrumentation for its Victoria Vintenair first.

► **Robert E. Wieden**, whose resignation as vice president of National Air Lines was last month, had accepted a job with Pan American World Airways as 1,697th director of personnel and health. Wieden departed after Louis B. Meyer became president (AW May 25, p. 49). Another April resignation reported to the Securities and Exchange Commission was the sale of 50 shares of Trans World Airlines stock, his earlier holdings, by Ben Fleischman. Second, a TWA director, is a former broker for Howard Hughes and a new one of three being used by Hughes over TWA financing (AW May 7, p. 42).

► **Interagency Committee on Transportation**, in its initial meeting last week, decided that its first project will be to establish economic criteria to determine whether stages should or should not be approved.

► **Continental Air Lines** Boeing 727 jet transport which concluded May 22 nonstop from Chicago to New York, had originally paid its former National holding, 1,697 shares of Pan American World Airways. Wieden departed after Louis B. Meyer became president (AW May 25, p. 49). Another April resignation reported to the Securities and Exchange Commission was the sale of 50 shares of Trans World Airlines stock, his earlier holdings, by Ben Fleischman. Second, a TWA director, is a former broker for Howard Hughes and a new one of three being used by Hughes over TWA financing (AW May 7, p. 42).

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► **First indication** that Aeroflot's Tu-134 turboprop transports are providing more than a token service came last month with the announcement that Tu-134s on the Moscow-Kharkov route would be used to twice daily. The 170-passenger aircraft are slated for three round trips daily on the trans-Siberian route beginning that month.

► **Debtors Department** has issued a directive implementing a Federal Aviation Agency regulation calling it a federal crime for all but authorized personnel to carry a deadly or dangerous weapon aboard a commercial aircraft. Persons so involved to carry a weapon must so notify an airline representative and present proper credentials.



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Fourth Jet Crewman Will Cost \$14 Million in 1962, ALPA Told

Many fourth-Jet crewman new members in the jet cockpit—who reduced U.S. airline profits by between \$25 and \$30 million in the past three years—will cost the industry another \$15 million in 1962, according to Continental Air Lines President Robert F. Strode.

During 1960, 1961 and 1961, Strode said, the industry's net profit was \$27 million—a figure almost identical to the entry it paid the fourth man. Next year, he predicted, the airways will not sign and work to dictate profits that could lead in the long run to additional pilots.

All U.S. jet transports are flown by three licensed pilots under policy established by the pilots' union. However, an union sources the third pilot doubles as flight engineer. Other members—Continental, Trans World, Eastern and Pan American—employ a third pilot but retain the professional flight engineer.

Addressing an Air Line Pilots Association board of directors meeting here, Strode warned that if ALPA wins its power in a "nonunion or solidar" manner, it could force government nationalization of the airlines. If this takes place, he said, the professional pilot's job will gain less lucrative. "For I do not believe the Congress will use the tax power necessary to pay salaries and benefits to nonunion members," he said.

These are Strode's words that pilots should identify themselves more closely with management efforts to turn a profit. Each captain, he said, can be the president of a "jet corporation" with assets of \$6 million.

The chief executive who can public entities with annual sales of \$6 million earned an average of \$72,000 last year, or somewhat less than an airline captain with 10 years to fly jets, Strode said. "The members are products of their corporations, which he compared with pilot first officers, earned an average of \$19,300. Chief Financial officers, who performed duties comparable to airline second officers in flight capsules, have an average of \$13,000.

At Continental, which has a highly developed cost control system, each jet flight minute costs \$11.98 and each minute of time spent costs \$5.72. If pilots, through poor flight planning, add three minutes of flight time and one minute of time in all Continental departments, this increases overall expenses with an item of \$11,700, Strode said.

Calling for more effective use of the public address system on each jet, Strode suggested that "advertising" fees disappear when it becomes apparent that

the pilot knows precisely where he is and exactly what he's doing." Poor safety is disastrous for those who believe it travel by air (IAW Mar. 21, p. 45). "If these people overcome their fear and fly, just to have that fear reinforced by seeing the statistics on the ground on a flight, there is no better waste of money," he said.

A carrier's solewise jet engine, in the aggregate, can "contribute substantially to which airlines survive and grow and how many perish," Strode said. Although that is now a serious matter, when inexpensive transports are introduced it will reduce price competition, for then "every pilot will have to accept responsibility for the thousands of dollars of profit or loss inherent in the way he operates his flight," Strode told the ALPA delegates.

The top pilots are clear when an airline becomes in flight econometrically, he said. As control of costs is lost, expenditures exceed revenues and losses eat up free funds, an airline for passengers will bankrupt. Then the big financial house of cards to loan big money to fast nationalization, forcing the airline into high-priced leases. Just that argument has higher hurdles to jump which completes the cycle.

For example, Strode said, the average jet airline for the industry cost \$6 cents a mile to fly. If the airline had to pay 10 cents to operate the same aircraft if it were owned, despite depreciation payments. "In simpler terms," he said, "eight additional passengers were required on each flight just to pay the extra cost of the leases."

When an airline faces pension payable years earlier, there is nothing left to cushion the losses from the following years and every extra dollar spent adds another dollar to the net loss, and so on. Eventually—an important change, Strode continues, materials and supplies become the cost—"the airline had it," he said.

Delta 9-Month Income Up From 1961 Period

Delta Air Lines had a net income of \$31 million for the first nine months of the fiscal year, a 23% increase over the figure recorded in the same period of the 1961 fiscal year.

Operating expenses declined 17% during the period to \$121.7 million. The carrier's load factor dropped 3% to 57.1% as available seat miles rose 28%. Domestic passenger miles climbed 12% during the same period.

Simplified Power for V/STOL Aircraft

Bristol Siddeley jet engine turbines are the optimum power plant for all V/STOL aircraft, says the British aircraft manufacturer, which has been developing the technology for both lift and forward speeds.

- The aircraft's unique space requirements are met by a single engine
- The simplicity of a single engine guarantees low maintenance costs
- It is capable of a large power margin for research and development

MULTI-ENGINE INSTALLATION

- Jet aircraft need lift engines
- Lift engines require a separate power source
- It is difficult to fit the two separate engines

SIMPLIFIED FLIGHT

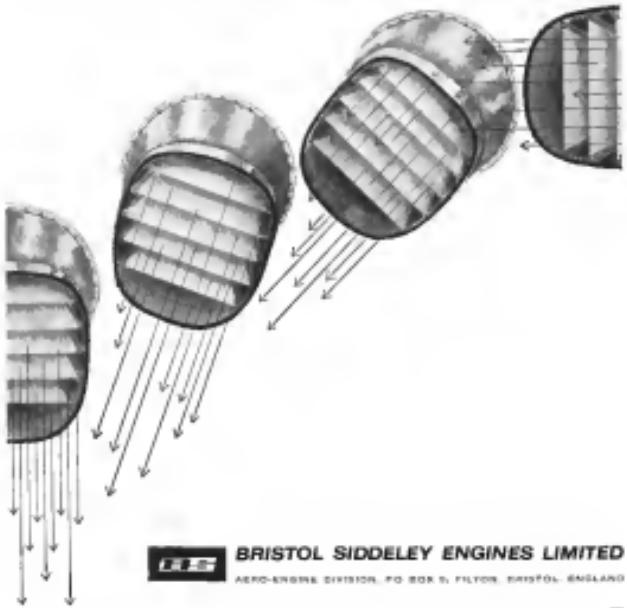
- Bristol Siddeley lift engines require no separate power source or air intake in addition to the air for lift
- Simplified flight

lift-off and approach flight. This places strict lift heating requirements.

- A large thrust demand for approach speeds with only a modest increase in speed, fuel consumption
- It is difficult to fit the two separate engines

Engines for research and development

- The aircraft's unique needs and requirements
- It is difficult to fit the two separate engines
- The aircraft's unique needs and requirements
- The aircraft's unique needs and requirements



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250-hour simulation run included 18 hours at 100% power under hot day conditions 45 hours at maximum continuous power. There were no shutdowns for engine problems.



Three afterburned JT8D's will power the Boeing 727. This compact jet is designed for profitable operation over long-density routes with 148 to 170 mile stage lengths.



Turbofan JT8D features 13-stage compressor, 4-stage turbine. Compression ratio is 16.5:1. The 14,000 pound thrust design achieves greater JT8 and JT5 features.

Pratt & Whitney Aircraft to deliver first JT8D turbofans for Boeing 727 flight tests

Sometime soon, three afterburned Pratt & Whitney Aircraft JT8D turbofan engines will power the Boeing 727 jetliner on its initial flight—little more than a year after the engine ran for the first time.

Such swift progress is possible because the JT8D's basic design has been proved by more than 20,000,000 JT8 and JT4 flight hours. Capitalizing on this experience, Pratt & Whitney Aircraft has developed a lightweight, high-efficiency powerplant with 14,000 pounds thrust. The JT8D achieves this advanced per-

formance through a design concept already familiar to operating personnel at 36 world airlines.

With its trio of turboducts, the 727 can operate at full load from 5,000-foot runways. This 530-to-600 high jetliner is designed for profitable operation over low-density routes with 148-to-170 mile stage lengths. To date, United Air Lines, Eastern Air Lines, American Airlines, Lufthansa, and Trans World Airlines have ordered a total of 127 planes. By 1963, the 727 will bring the benefits of jet travel to new cities throughout the world.

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SERVICE TEST of the prototype of the 40,000-lb cargo loader-expander vehicle for USAF's 463L Materials Handling Support System is conducted at Tinker AFB, Okla., with a Boeing C-130 jet transport operated by Military Air Transport Service. Three prototypes produced by American Machine and Foundry Co. are presently undergoing service tests of MATS lines.

463L System Integrates Cargo Handling

By James D. Hendricks

Wright-Patterson AFB, Ohio—Prototypes and production contracts for about one-half of the cargo handling equipment at USAF's 463L Materials Handling Support System will be awarded to Aerostar's Surface Division here within the next three weeks.

Initial plans to integrate with the C-141 Starlifter are being tested for cargo loader development. In Lockheed Georgia Division (WAT Dec. 9, 1961, p. 46), the 463L system is designed to give the Air Force a simplified rapid transit cargo control and shipment operation by 1965—operational target date for the C-141.

Aerostar's 55 surface line has already been spent in research and development work on the 463L system—most of that for the development of prototype equipment. Aerostar is requesting another 55 in a contract for R&D funds to complete development of the system by the end of Fiscal 1963. USAF anticipates total funding cost through Fiscal 1965 at about \$64 million, although the figure may jump to as high as \$100 million covering total purchase of integrated Air Force bases.

Commercial cargo operations might also be the target of the 463L and C-141 program, since both were designed with both military and commercial roles in mind. The C-141 is the first airplane ever planned to devotion to

development with a family of cargo handling gear.

The idea is that the Air Force is placing an expectation of the two aircraft in development and operation in integrated by the fact that both are managed here under the same name of Systems Program Office (SPO) headed by Col. M. B. Henneman (WAT Sept. 25, 1961, p. 250).

Other Aircraft

The 463L equipment will not be used exclusively with the C-141. Air Force is working toward application of 463L techniques and equipment to several other types of jet and propeller-driven transports. These include the C-130 and its main competitor, the 707, the DC-8, DC-9, Convair 880, C-134, C-136, C-138, CL-44 and AC-4. The Air Force could end up with the majority of the 463L system in the C-130, which is in charge of 463L development within the SPO.

Contract Due

Selection of contractors to construct prototypes and produce 463L equipment will be handled by ASD as program manager. The study from which 463L evolved was completed two years ago by Douglas Aircraft Co. (WAT May 2, 1960 p. 41).

Contract awards will be parallelly granted by DOD policies which dictate equal consideration for small business and where possible, preference for low costs located in areas of economic depression. Approximately \$13.9 million will be spent this year to initiate production of 463L equipment. These are the first funds allocated for production within the program. The

following production and R&D awards are due by June 30, the end of the current fiscal year.

■ **Cargo loading system.** This equipment is divided into three separate systems for installation aboard C-141, C-130 and C-133 transports to convey and return cargo via pallets inside the aircraft. Each system consists of four sets of pallets, each set having four pallets, four pallets, four pallets and four pallets. The C-141 and C-130 systems will include lateral adjustment capability in positions 55-in. and 165-in. pallets. The C-133 system also is to include forward-pushing wedges of USAF and Army materials carried on the standard 106-in. Army skid-frame, airlock pallets. ASD is evaluating industry proposals to furnish 50 units for the C-130, with the supplier to be picked by summer. Douglas is participating in the C-133 loading system under a \$1.5-million contract. USAF plans to use the C-133 aircraft for transporting the Minuteman ICBM and Titan I booster engine segments weighing 30,000 to 40,000 lb to Australia. Macmillan and Friends Co. has developed a prototype of the C-134 system, and USAF will determine a supplier and award a production contract during Fiscal 1963. USAF will purchase 100 of the C-134 system, which will be installed on four aircraft. These four aircraft will be used to support the six aircraft those in direct support of the six aircraft.

■ **Cargo pallets.** Goodrich Aerospace Corp. has a contract to furnish about 1,460 small pallets, consisting of 88 x 54 in. USAF will select a small business contractor to produce about the same number during Fiscal 1963. Goodrich's initial pallet will be about \$12.5 million. The small pallets, which will be used in the C-125, C-126 and C-130, will have a 5,000-lb capacity at 90% of gross stacking height. They are to be transported in planes not equipped with the cargo loading systems by taking them to the door-to-door liftings. Goodrich produced approximately 1,200 large pallets, 88 x 118 in., during Fiscal 1961, and these were later sold to the Air Force. Defense Electronics produced 250 the same year for the Air Force. Total of 1,280 large pallets will be purchased in Fiscal 1962, with the contractor to be chosen by January 1963. Goodrich will be bought in Fiscal 1963, making the total funding for large pallets approximately \$3 million. The large pallet will have a 10,000-lb capacity, with other specifications generally the same as the smaller version. USAF is also considering purchase of an 88 x 118-in. pallet, Peterson told *Aerospace Week*.

■ **C-130 unloading ramp.** ASD contracts on this item is scheduled that summer. The ramp is designed for attachment to the C-130 landing gear during takeoffs. The 40-ft, one-

transportable ramp is intended to facilitate unloading of heavy palletized cargo at forward airfields where no sophisticated gear is not available. Design requirements call for a telescoping, folding or collapsible system which can be transported manually or automatically by two men and which will accommodate full C-130 load of 46,000 lb and 165-in. pallets. Design weight objective is 500 lb.

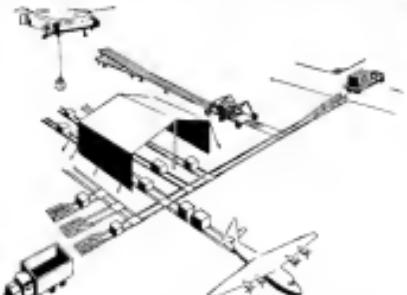
■ **463L B-1 loader-expander track.** This vehicle, already available in prototype form from AMF (WAT Sept. 12, 1961, p. 51), is scheduled for use only at large, heavy traffic cargo terminals, such as the cargo MATS bases. The vehicle, driven by an operator seated in a hatch at front side, can move over the conventional cargo bed, has a powered spread of 15 inches. The 45-ft long vehicle can adjust its height to 60 inches or lower. Design requirements call for a capacity of 10,000 lb when using the C-130, with its height reduced during loading to 60 in. and width to 128 in. Other specifications include 40 ft x 136 in. height adjustment, 7 deg. fine and off pitch, 5 deg. roll, an 8,000-lb capacity track, ground loading ramp, single lift, hand-operated pallets, locks, pallet pusher capability at the front, a power and chain conveyor, and pallets around the sides for cargo handling. There are also two versions at Tinker AFB, Okla., MacGregor AFB, N. J., and Tachikawa, Japan. A recent test conducted at the new cargo terminal at Tinker, the 40,000-lb truck and four men loaded and unloaded 36,000 lb of cargo from a

C-135 in 18 min. USAF is seeking a 30-min. blocked time for cargo transport needs. This includes loading and unloading a plane while it is being refueled.

■ **25,000-lb loader-expander.** AMF has the prototype owned on the vehicle also and it is similar, except respects to the larger gear. The 25,000-lb cargo truck is being developed for in Germany with Tiefenbach Air Component, Fogg AFB, N. G., and Sewart AFB, Texas, and with Logar at Ogden Air Materiel Area. The smaller vehicle is designed as a walk-on vehicle at most small and medium-sized permanent bases, but will not be used in forward areas. Air Force plans to buy 105 in Fiscal 1963.

■ **Cargo loading trailer.** This adjustable-height trailer will be towed by a prime mover and will be utilized to forward cargo depots for use in supporting cargo operations at forward airfields or bases. The cargo will be fired with four 10-cubic-yd palletized or palletized cargo or vehicles with high load. Payload will be 18,000 lb. It will also be utilized at large permanent depots to supplement the 40,000-lb loader, for example, if it could be located behind the large loader and carry 13 of the large pallets to reduce a full C-135 load one trip from the storage point to the use point. An R&D contract for the trailer is in progress.

■ **Palletized cargo trailer.** Initial Fiscal 1962 production will total 1,000 trailer units, with 100% of the units available for fiscal 1963. The trailer has a removable lift table trailer plate as a cargo bed, providing removal of ma-



EMERGENCY TERMINAL, shown in USAF's initial concept, is proposed for adding to forward areas during brush fire war to handle flow of war materials. Large transportable structures would provide weather shelter for palletized cargo.

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terms in any duration without the need to have the motor. Two sets of anti-soft switches will be used to limit and reverse current or to lift the trailer for short periods of time with a high dose circuit. Each trailer has a 10,000-lb capacity, a 110-in. long by 90-in. wide and 15-in. high, and has a steel safety shield. The trailer will be equipped with locking devices at each end, existing cargo has often to be moved to a trailer in a form of a spiral of 5 miles. In Final FDR, USAF will purchase another 140 trailers, completing the order.

Rough terrain loader. 3000 cu ft contract is on this device, which will be used to haul cabs over distances up to several miles at transport speeds of 10 mph. The crawler-based unit has a flatbed deck designed to haul trucks, the vehicle will load and unload cabs from haul roads, load, and bright plates. The rough terrain loader is to have 21 mph speed capability, 30 deg side slope tolerance, 10 ft arms crossing and landing depth capability, and a 30,000 lb maximum payload length will be 170 ft, with 110 ft maximum (100 ft for air transport), and height 37 ft to the top of the cab. The rough terrain loader will have a maximum rear height of 10 ft and an adjustable height of 37 ft to all 4 wheels. The rough terrain loader will have 5 deg side capability, pitch levels of 3 deg forward and 16 deg aft, a ground loading ramp, an 8000 lb capacity winch, and a hand-operated pallet lock. Another gear is to include a bulldozer blade for smoothing out the terrain at least of the loader since several blades and a power take off.

Emergency mission pallet. USAF helped to move an AFM-2000 contract during Fiscal 1981 for this short-notice pallet for be-timed delivery to prepackage airmail materials and supplies as a means of reducing aircraft ground loading time. The pallets will be designed for transport with the handling equipment aboard military cargo airplanes and for airdrop capability from the C-141, C-130 and C-160. Briefly, USAF wants a lightweight, suspensible pallet in two sizes, 80 x 49 in with 1,000-lb capacity, and 68 x 105 in with 10,000-lb capacity. It is to have 7,500-lb payload, be-drawn ramps along the sides, and an integrated shock absorber and shock absorber for rough landing in all types of climate.

Weight and balance system
This system is located for the C-150 and will indicate accurate weight and balance loading factors while the aircraft is on the ground or in flight. The system will utilize pressure sensors located in the landing gear and nose gear and will feed pressure data back to a remote

Boeing Studies Effects of Vibration on Pilots

station between 1 and 10 sgs, with amplitudes of 20 μ V at lowest frequency up to 60 μ V at highest frequency as produced by hydrostatic influences activating a phasic increase in heart rate at Bonaig Mochrie. Abnormal heart rate dynamics influence on human performance are being evaluated for Office of Naval Research. At higher frequencies, phasic heart rate dynamics are more difficult to measure accurately than cardiac control. Other effects are load due to exercise, verbal confusion and noise interaction.

des within the aircraft. The computer will handle weight and balance loads, and calculate three standard weights based on an mission in the flight calendar. It will also calculate the load factor, and the aircraft's center of gravity. The computer will also calculate the aircraft's weight and center of gravity, and weight constraints. It will then use the figures to calculate a weight

- **Fork lift.** USAF will buy two no. 6,000-lb. and 10,000-lb. capacity. Block lift, adjustable mast lift to enable the operator to maneuver and load/unload aircraft ordnance.

and training planning, initialization, development, and recording of design reports as related to possible C-17 aircraft trials. The USAF plans selected a contractor during Fiscal 1984 to develop weapons handling equipment as proposed, with a prototype development set for Fiscal 1985.

designed for safe storage of large quantities of energetic oxygen components, up to approximately 25,000 lb, aboard aircraft transports. In rough design, it is a cylinder 20 ft long with additional venturi devices and shielding sections to secure the component and to prevent damage caused by lightning strikes.

House-drawn vehicles USARP will be the first to use these vehicles as an alternative to trailers and will be more in older style than the modern vehicles. The standard portable wheels is drawn by a 0.6, 400 cpa hydraulic power unit and will be mounted on mobile trailers. The weight of the trailer will be 1,000 kg and will have a 4,000 kg gross weight. 1,100 kg gross weight will be used with the trailer's controls and load planform mounted in the carriage. The track is designed for use in steppes or softening gullies and can be folded up and be used inside buildings. The carriage is a high density carriage and has low fuel consumption and low fuel storage requirements. The carriage is designed to prevent the use of less armoured and heavier equipment. The track is a 1000 mm track, 140 mm wide, 14 mm thick with the platform, below 50 kg.





How to enhance reliability of critical avionics equipment!

A good equipment design, proven under laboratory conditions, may sometimes perform erratically during field life. Why? Consider the type of components used. Are they field proven? Do they offer documented reliability?

Take the case for electronic vacuum tubes. Tests by ARINC Research Corp.¹ illustrate the dramatic improvements in tube reliability since 1955. The result of tests conducted showed that, for example, a 20 percent failure rate survival rate of 1955 gave 1000 hours at 1955. By 1960 this figure dropped to 1.25, for miniature tubes, and a remarkable 0.18% for subminiature tubes. All the controlled miniature types in this test were Sylvania tubes.²

Electronic tubes are virtually unaffected by extremes in environment. Example: Sylvania G8 Gold Brand tubes, specifically designed for two new commercial avionics, main-

tenance and performance even after shocks of 300g, fatigue tests of 2.3g for 95 hours, bolt temperatures of 165°F. They are unrivaled in electrical stability, longevity and ease of interchangeability.

If avionics equipment reliability concerns you, be specific about the components you use. Make certain they are specifically designed and tailored for the Sylvania G8 Gold Brand requirements on these tubes. A complete line of G8 Gold Brand types, and prototypes, is planned for the writing. Also from Tubes Division, Sylvania Electric Products Inc., 1000 Main St., Buffalo 2, N. Y.

¹Courtesy ARINC Research Corp., as published in publication #414 9118-4151-76-80.

²Tables were developed in 1960 SRR 124, against Commercial vacuum tube reliability data, for the 1955 and 1960 failure rates. The 1955 data is from 1955 tube reliability statistics of various American tube makers—AT&T, 3M, GE, RCA, 2000, 2000, 2000, 2000.

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and 1.4gals above 39 in., maximum lift height of 100 ft., and a platform 48 in. long by 42 in. wide. The test is. Then will determine whether USAF will issue a procurement order and in what quantity.

• **Marked trailer kit.** Strategic Army Depot men San Francisco are assembling 36 of these units for shipment to Pacific areas where they might be used in emergency situations. The kit will provide for standard reparation of standard-bladed wings in order to mate with 45L pallets. The kit is to include manpower, grade soils and platform material for mounting trailer bed and walls as required. One of the trailer requires a motor vehicle and a truck, but is much less expensive than the purchase of large trailers at bases where they would receive refrigeration use.

• **Insulated food container.** USAF will determine its requirement for these by the end of fiscal 1961. They will be used primarily to transport frozen food to remote stations along the Arctic DEW (Distant Early Warning) Line sites. USAF is considering three tons with capacities of 400, 800 and 1,600 lb. The containers would be mounted on the standard cargo pallet and would incorporate a temperature gauge. They would be able to provide thermal protection for fresh and frozen food for periods up to 20 hr. at temperature extremes from -21°F to 100°F. The containers are to have leak test and seal and pallets on the sides for heat shielding. ASD may award a production contract at the year before for each unit cost.

• **Consolidated container.** This is to be an expandable, tri-folded, corrugated fiberboard box with dimensions compatible with one eight, one fourth and one half the size of the 108 in. pallet. Small sizes of cargo with a cushion, dehydrated and thermal property can be fitted into the consolidated container to save space and load weight in the aircraft. The boxes will be available in 27, 48 and 72 cu. ft. ASD wants to receive test the three sizes of containers in MATS and Lager operations before reaching a decision on their worth. If accepted at a price of \$100, expression of the fiber board boxes would be a logical purchase.

• **Conveyored belt lift fixture.** An other local provision item, the device consists of a conveyor belt fitted with cradles for the tons of the 10,000 lb. lift belt. The fixture is to be used for loading and unloading pallets from either a high or low aircraft. The conveyor belt is equipped with restraining locks for the cradles to prevent the cradles from falling off the conveyor belt and walking off either on the ground or raised loading of an elevated pallet. • **Cargo lift rack.** This equipment will be purchased for the major cargo han-

sels to 40 protective netting over palletized cargo. It is basically a metal frame fixture designed by a local lab. When positioned by the pallets, the net frame is raised above the pallets and the net is lowered onto pallets and secured. The net is raised by spring loaded hooks on the rack. When the net is secured in the pallet, the fixture is raised again, and the hooks drop free automatically from the net.

Cargo Terminal

The first cargo terminal to assist mobile cargo portion of the 45L lift team went into operation at Travis Air Force Base, Calif., and much of the system's equipment being tested took there. Travis is MATS' major passenger and cargo terminal on the West Coast.

In the new freight terminal, mobile container pallets and supplies are sorted and weighed automatically, sorted using conveyor belts to points where they are pre-packaged according to part and destination, or transported by a mobile conveyor belt system. The mobile mechanical cargo system handles cargo items weighing up to 500 lb. at the rate of 441 items per hour.

The Boeing Co., manufacturer of MATS' C-141 jet transports, is equipping the aircraft at the factory with sole rights which facilitate guidance and lateral and vertical motion for 45L pallet lifts.

The lifts are laid out so that the pallets can be moved lengthwise or crosswise into the cargo carriage. Roll on and a hand truck plate are used to move the pallets under the C-141 transports.

MATS and Lager also are examining rail car carriers using auxiliary equipment connected to outfit their planes with the rail transfer plate at least to easily allow loading and unloading of the pallets, which are moved inside the aircraft to standard cargo bay receiver rings.

Eventually, all USAF bases will have mechanized cargo handling to some degree. Personnel are to be taught mechanics of the system and the mechanics, as it might occur, completely disassembled cargo terminal, positioned along the lines of the Travis Intermodal Hub. By 1965, six cargo bases will be totally intermeshed under the 45L program. MATS will coordinate its major ports of embarkation, and Logistics Command will anticipate the Materiel and Materiel (AMA) under guidance of the 45L SPC.

ASD helped to design plans for the automated AMAs at Ogallala, Okla., McGehee, La., and Warner Robins, Ga. These 1965 plans call for interlocking terminals at Dothan AFB, Ala., Duluth AFB, Minn., McGehee AFB, Wyo., McGehee AFB, N.J., and Chincoteague AFB, Va. MATS also wants

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the terminal at Kurea, Oklahoma, automated, according to Petersen.

The rough cargo for a typical 463L automated terminal shows a series of corrugated figures standing from a truck including desk, mask the main cargo building. The automatic sorting and weighing devices separate the pieces of cargo by priority and destination and route them along other conveyor lines further inside.

The cargo is loaded separately at an automatic pallet conveyor operating under a platform which rests at floor level or below 6' off the floor. Once palletized and secured with a cargo net, the cargo is transported, probably by fork lift, to an anti-set mode for use prior to destination. The cargo is also sequenced for offloading priority, so the user is to be carried aboard an aircraft earlier than one with less weight or priority considerations.

When the aircraft is ready for loading, a 43,000-lb. or 35,000-lb. loader is pulled up to the flight line, side of the terminal, and the pallets are moved on for lift, and placed on the loader for the short trip to the plane.

ASD also is proposing as an transportable terminal (one drawing no. 521) which could be moved to supply situations at forward areas during emergency operations. It might consist of two palletizing areas, each with a pallet conveyor system which could be placed on the ground, and the rough cargo loaded.

The shelter would be constructed of light-weight structural components to provide rapid and easy erection without the need for special tools. In assembled form, the shelter and related gear could be transported and assembled, if necessary, from cargo aircraft. All equipment used in the emergency terminal is to be composed of mobile, reusable equipment of minimum size and maximum adaptability.

The transport terminal would facilitate the transport of supplies, parts and supplies which usually begins at about 12-15, or five days after the creation of an emergency such as a landfall of a hurricane. ASD says that a R&D contract for the terminal this summer, with the first phase calling for study of basic parameters and required equipment.

USAF has established these basic goals in the planned development of the 463L system and the C-141.

• Uniformity of cargo operations. This encompasses the separation of cargo by destination and priority and the bringing together of load items onto a load carried by the consolidated container. It also calls for standardizing handling equipment, particularly the pallets and aircraft loading systems, so that cargo can be shifted easily on its pallet load.



DH-125 Seating Show

De Havilland DH-125 model at Hunter Air Show shows possible seating arrangement. In parentheses, with first use of static loading material. (Photograph by Bertel Schilder) Above: DH-125 with European defense assistance for a combination of military users, ranging from a user in a hospital airplane. Royal Air Force reportedly is considering an order to 50 aircraft in a variety of configurations. The Vraptor, which she will see General Electric C-141C transports will carry up to 19 passengers. Two prototypes of the aircraft are currently being constructed by Piggott.

as transport to surface or sea shipping vehicles or vice versa. Another function is in the pre-delivery of strike force materials for forward Air Control. USAF wants this materials on 500 pallets for pickup purposes. Two 500 pallets can be joined in one 1000, model, then in turn be set up in an emergency area, broken down again into two 500 pallets and loaded aboard a TAC aircraft for landing at the forward area. The aircraft would then fly back to the emergency area of the world to launch the vulnerability of the aircraft to enemy attack.

• Cargo handling mechanisms. This is an economic system—in terms of time and money. USAF says that it is \$15 per hour for storage as required in the use of 463L equipment at terminal handling, 14,000 hours of cargo per month. Additionally, automation of cargo storage should cut these costs to 10 percent of the time and money of handling by a human or cargo handling equipment. For example, the new Texas Air National Guard handles a daily average of 300,000 lbs. of cargo. With full 463L capability, that terminal should handle up to 8.7 million pounds daily in times of emergency, Petersen says. This 4000-ton unit will fill its cargo bay completely and storage of some cargo on deck, he adds.

• Philco's system and single-destination control. USAF wants a two-procedural system to designate an unconsolidated set of materials. The present system has four priorities, numbered 5, 4, and early low (50) groups, 1B, 1C, 2A, 2B, 3C, etc. This priority would assign priorities of equipment and would include about 20 to 30% of the total normal operation, according to Petersen.

and jump up to as much as 160% in emergencies. The second priority would be all other cargo eligible for shipment as well as determined by an automatic control system.

The move for single-document control of cargo items appears to be similar in a large series of moves to reduce the tremendous amount of paper work that has long plagued the military in most of its operations. DOD's recently developed system, called "MARS" (Mars—Mars library), is to trim the number of cargo labels and control documents to the absolute minimum needed to keep track of cargo movement and priority. Petersen says that system dovetailed with 463L requirements.

ASD is to recruit several sub-subsets for 463L operations as planned for R&D funding, during fiscal 1983. It will eventually be linked with USAF's global 463L equipment system requirements.

The inherent system incorporates three major components. One is a load plan, a small machine which could provide one load template for complete routing of cargo from source to destination at the rate of four labels per minute. The planter would have a life expectancy of 10 years.

The second is a shipment planner. It is a computer device which will be employed at the point of cargo origin to estimate all available shipping methods and determine method of shipment, priority, and the shipping agency to which the item will be sent.

It will receive messages on cargo availability and location and forward messages. The planner also will provide a key panel Transportation Accounting Data (TAD) card, which will control cargo



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flow and automatic accuracy control data for hydraulic operations and static loadings.

A third proposed subsystem component is a data integrator which would receive and store input data from all various cargo reports, cargo except cargo segment, cargo and flight schedules. Major functions would include blocking sequencing, load planning, statistical control and processing of blocking data.

The C-141 and an associated 300-ft cargo handling equipment have been given the name program designation of "ASD," or Airlift System Description, the name and the functional equipment will be relative to each other. For instance, the public convenience which must be installed in a aircraft size in cargo transport will be built into the StarLifter.

Parametric studies indicate that the C-141 can analyze over 15,000 lb. loads of equipment without disturbing the aircraft's center-of-gravity, according to Maj. Gen. Robert F. Hobart, plan and programs officer. Troops and cargo can be transported simultaneously, with jumps and landings in the role having been made for cargo being carried through the pallet doors at the rear of the cargo envelope.

Although no development contract is planned at this time, ASD is considering the installation of high density air-lifting personnel seats for extracting long range transport passengers. On this type of flight, an 88 x 105-in. pallet would be locked in place at the forward end of the cargo area to provide a central modular station containing food, water and toilet facilities, Hobart said.

Liquid oxygen canisters will be carried in the landing gear pods to furnish emergency oxygen, and two external 20-in. dia. life rafts can be carried in the pods. Other rafts can be added in storage areas along the trailing edge of each wing.

The StarLifter will have capability for carrying up to 127 passengers, with an additional 100 in a rear cargo bay, with the fuel load and two seats removed along the center. The aircraft will be able to transport 154 ground troops in this seating configuration, since this requires less personnel engagement than the passengers. However, the seating capacity and configuration probably will be governed by seat and insulation equipment available at the time of aircraft design in a emergency.

Oxygen supply can also alert personnel landing experts. The crew oxygen system will be able to supply 100 cubic ft. of oxygen for three hours at 7,500 ft. above sea level.

On medical evacuation flights, the StarLifter's cargo envelope can accommodate 30 personnel when stacked three high, with eight abreast.



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VOUGHT-RYAN-HILLER XC-142 tri-service VTOL transport, shown in model form with wings in vertical or hovering position, was designed for good handling characteristics and growth potential. Engines are General Electric 164s.

XC-142 VTOL Transport Design Emphasizes Minimum R&D Risks

Design features of the Vought-Ryan-Hiller XC-142 tri-service VTOL transport emphasize good handling characteristics and minimize research and development risk in the principal components of the aircraft.

Examples are:

- **Mechanical integrator linkage** to automatically transfer cockpit control motions from one control surface to another as wing tilt angle changes, simplifying control during transition between vertical and horizontal flight.

- **Conventional clutchless bearing** propeller and engine and 8,000 rpm cross-shifting that from the four engine gear boxes to permit engine shut-down at flight without disastrous effects on control.

- **Leading edge flaps** on the outboard side of each engine to prevent uptake of propeller slippage during transition from vertical to conventional flight through engine gear shifts.

- **Dual servowick actuators** in the wing tilt mechanism to provide fail-safe reliability and sufficient stiffness to allow for wing elasticity.

- **Conventional propellers** and a horizontal tail rotor were designed instead of the cyclic propeller pitch control sometimes proposed. Cyclic propellers would add one more development risk to the aircraft. It could not control the control power or develop enough vertical lift of the tail rotor. It is easier to change the diameter or speed of a tail rotor than it is to revise the design of a propeller cyclic control system.

During transition from conventional flight to hover, the mechanical integrator linkage shifts yaw control power from the rudder to differential collective pitch propeller control and finally to the actuators in the propeller slip-

stream. Pitch control shifts from the all-moving horizontal stabilizer to the tail rotor. Roll control shifts from the ailerons to differential collective pitch control of the propellers. Control modes overlap to make transitions smooth. All primary flight controls are powered by dual hydraulic systems. The tilting wing is equipped with full-span double-slotted flaps. The outboard flap sections also serve as aileons.

The wing has an aspect ratio of 8.6 and can be tilted at an angle of as much as 100 degrees, enabling it to fly horizontally. Tail assembly of the XC-142 consists of a conventional vertical fin and rudder, an all-moving horizontal stabilizer and the eight-foot diameter tail rotor which is driven from a fuselage accessory gear box connected by an 8,000 rpm, takeoff shaft to the engine cross-shafting. The XC-142 is powered by four General Electric 164 turboprop engines developing 2,550 hp. each. The 15-ft.-dia, four-bladed propellers are being developed by Hamilton Standard as are lightweight gearboxes.

XC-142 Specifications

Cruise speed	350-380 kts.
Max. speed	300-400 kts.
Combat radius	200-300 nautical miles
Range	2,200-2,600 nautical miles
Payload	8,000 lb. (32 troops)
Cargo compartment size	30 ft. x 7.5 ft. x 7 ft.
Carries suitable	Dismounted limitations: 50 ft. x 30 ft. x 17 ft. & gross weight of 35,000 lb.
Wing span	67.5 ft.
Length including tail rotor	58 ft.
Height	26 ft.

Engineers on the project claim good growth potential for the XC-142 with more powerful engines. With a slight increase in wing span and some strengthening of structure, a more powerful engine than the 164s should be able to carry a payload of six tons with a STOL capability of clearing a 50-ft. obstacle in less than 500 ft.

PRODUCTION BRIEFING

Electronic Specialty Co., Los Angeles, will design and manufacture a 44-ft.-modular support instrument station for the Army's Pershing missile under a contract exceeding \$460,000 from Martin-Orlando, Pershing prime contractor.

Sod Aviation of France has ordered simplex and multiplex versions of the Smiths automatic landing system for installation in two Canaville transports now at Toulouse.

Massachusetts Institute of Technology will perform additional research on reentry physics and range measurements under a \$4.9-million USAF contract sponsored by Advanced Research Projects Agency (ARPA).

Shawnee Industries, Inc., Shawnee, Okla., has received a contract from Lockheed Georgia Division to manufacture doors for the C-141 turboprop USAF cargo transport.

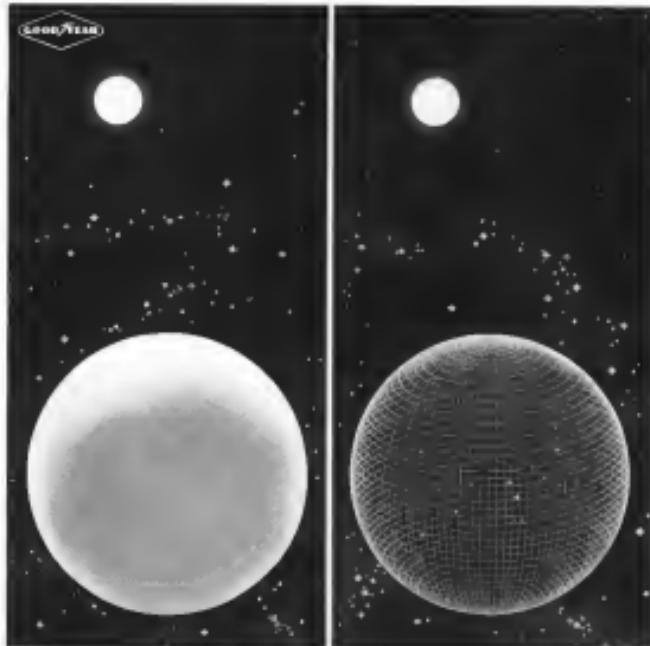
Republic Aviation Corp. has received two Navy contracts worth more than \$1.5 million to design and develop a steering and diving control system for the Navy's Dolphin experimental submarine and to design and fabricate a ship's control and hoisting device for the Lafayette, a Polaris-launching sub.

Bell Helicopters has turned over the first four of 16 HU-16A Iroquois helicopters equipped with six SS-11 guided missile launchers to the Army for field evaluation at several bases.

Collins Radio Co. will furnish communications identification-navigation (CIN) systems for Republic F-105 Thunderchief fighters-bombers.

Ling-Temco-Vought, of Dallas, Texas, plans to hire 1,200 more engineers this year for work on space, missile, aircraft, electronics and commercial programs.

General Precision, Inc., Binghamton, N. Y., has received a \$1.5-million Federal Aviation Agency contract for work on the transition and terminal area data processing and display equipment at the National Aviation Facilities Experimental Center (NAFEC) near Atlantic City, N. J.



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EQUIPMENT



B-58 Hustler is lowered into position at National AFB, N.M., for weighing and determination of its center of gravity by electronic computer

Computer Determines Weight, Center of Gravity



Gross weight and center of gravity of two B-58 Hustler bombers have been obtained by use of an electronic weighing and computer planning system designed CPAM-5 and built for USAF by the Electronics Division of Baldwin-Lima-Hamilton Corp., Willowbrook, Ill.

CPAM-5 system (Computer Planning and Aircraft Weighing System) can compute for any and hundreds of sprung locations. System was originally designed for cargo aircraft and has been built for and delivered to Military Air Transport Service, Wright-Patterson AFB, Ohio.

For cargo aircraft, the computer can calculate cargo weight and placement for up to 13 compartments and estimate the maximum weight which can be carried in each. System will hold load records of previous aircraft's load profile to then compensate loading and computing for weight and center of gravity.

First planning is a capacity of 200,000 lb. Each location is equipped with strain gauges bonded to a resistive column. Accurately angled on the platform, gauges convert the column which is measured by the gauge. Then converted into electrical signals which are fed into the computer.



Now gauges positioned on platform which rests on load cells and pods in the four corners. Ties have been stretched. Main gear rests on separate platforms. Readouts for weight and center of gravity appear in windows in control console, shown above left.





The Lincoln Laboratory program for ballistic missile range measurements and penetration research includes:

EXPERIMENTAL RESEARCH

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NASA Contracts

National Aeronautics and Space Administration recently awarded the following contracts and research grants:

RESEARCH CONTRACTS

1. BRL Brad Corp., Somerville, Calif.—\$100,000 for research on thermal protective materials in space.

2. MRC Materials Research Corporation, Worcester, Mass.—\$100,000 for research on the effect of increased polarization in space on the behavior of materials. (Contract No. 12-1000-100000)

3. BRL Brad Corp., Belmont, Calif.—\$100,000 for continuing research on the development of a new technique for determining the performance of materials under conditions of constant-rate heating.

4. University of Colorado Boulder, Boulder, Colo.—\$100,000 for investigation of water vaporization in the presence of a vacuum.

5. University of Texas Austin, Tex.—\$100,000 for research on the effect of temperature on the behavior of materials.

6. University of Michigan, Ann Arbor, Mich.—\$100,000 for investigation of the effect of water vapor on the behavior of materials.

7. National Research Council, Ottawa, Ont.—\$100,000 to investigate the effect of temperature on the behavior of materials in space.

8. University of Michigan, Ann Arbor, Mich.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

9. University of Wisconsin, Milwaukee, Wis.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

10. University of Wisconsin, Milwaukee, Wis.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

11. University of Michigan, Ann Arbor, Mich.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

12. University of Wisconsin, Milwaukee, Wis.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

13. University of Wisconsin, Milwaukee, Wis.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

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22. University of Wisconsin, Milwaukee, Wis.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

23. University of Wisconsin, Milwaukee, Wis.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

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This A. W. Haydon ETI is ideal for applications where space is a problem. Less than 1/2" long, 1/16" "dia." its production test probe is record to 9,000 hours at better than 99.3% accuracy—much more reliable than what it's testing. The 23200 series for 60 cycle, or the 25200 series for 400 cycle rate on 3 watts of 115 v., exceed requirements of MIL-M-7793. These ETIs are tested for service from -65° to +250° F., altitude to 80,000', 20 g vibration up to 2,000 cycles. To get full details, write The A. W. Haydon Company today.

AWHAYDON COMPANY
 125 North Bedford Street, Lexington, Massachusetts 02122

plan where facilities are limited by size.

24. University of Michigan, Ann Arbor, Mich.—\$100,000 for research on the effect of temperature on the behavior of materials in space.

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MICRO MINIATURE
ETI

**tiniest timer
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This A. W. Haydon ETI is essential for applications where space is critical. We don't know of any other ETI that can stand it for size—only 1/4 cubic inch. It records tests at 99.3% accuracy—much more reliable than what it's testing. The 23200 series for 60 cycle, or the 25200 series for 400 cycle rate on 3 watts of 115 v., exceed requirements of MIL-M-7793. These ETIs are tested for service from -65° to +250° F., altitude to 80,000', 20 g vibration up to 2,000 cycles. To get full details, write The A. W. Haydon Company today.

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HYDROFOIL defense is facilitated by Ryan Doppler Navigation Systems which make possible accurate, continuous, all-weather navigation over land or sea—anywhere in the world, without accurate navigational aids.

SATELLITE SPACESHIP—Ryan Doppler navigation systems, recently selected by Hughes Aircraft Company, Inc., to design, develop and fabricate the Radar Altimeter and Doppler Velocity Sensor equipments for NASA's Surveyor Lunar Soft Landing Spacecraft.

RADAR ALTIMETERS are being designed and built by Ryan Electronics for the Surveyor launch vehicle. These short pulse, high-altitude radar altimeters will be capable of recording altitude measurements up to 250 miles.

How to keep a high-speed hydrofoil on an even keel?

To prevent hydrofoil ships from porpoising, a radar altimeter, capable of setting height changes of as little as one inch, is now being built by Ryan Electronics. It will be used to anticipate wave action... automatically adjust underwater foils... and keep the ship running steadily—even in rough seas.

Ryan Electronics is designing and producing three types of radar altimeters (phase, PAVCOV, and pulsed) that bridge the broad spectrum of earth and space requirements. This total capability results from Ryan's 15 years' experience in the design and development of electronic systems and the company's present position as the leading producer of Doppler navigation systems for all types of aircraft.

Flexible and fast-moving, Ryan is also making significant contributions in other areas of aerospace progress. The company has major roles in two of the newest and most promising WSFRDL aircraft designs—the Army VZ-11 and Tri-service C-142 research aircraft. Ryan is the largest producer of jet target drones for the Armed Services. Other Ryan activities are Flex Wing programs, space structures and ground support systems.

Ryan Electronics includes the most modern and best equipped facilities for electronics development, manufacturing and testing. At Ryan Electronics and Ryan Aerospace, technical and management capabilities are designed to insure compliance with the most stringent standards.

RYAN AERONAUTICAL COMPANY, SAN DIEGO, CALIFORNIA

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Astronaut Virgil I. Grissom (left), capsule communicator, and John H. Glenn, Jr. (right) listen to voice communications at Cape Canaveral



during Carpenter's Gemini-7 flight

SPACE TECHNOLOGY



Edwin E. "Buzz" Aldrin, chief of flight operations, NASA Manned Spacecraft Center, gives "go" sign in Mercury Control Center

Mercury Team Supports Astronaut Carpenter

During Flight



Astronaut Scott Carpenter makes an Mercury capsule "zero" at Cape Canaveral, Fla., prior to three-orbit flight which began at 7:45 a.m. EST May 24. Note reflection of technician on facplate. Carpenter had the only time he was comfortable in his pressure suit and was weightless (AW, June 4, p. 316). After landing in ocean, Carpenter left capsule through an airlock hatch.



Carpenter's blood pressure is measured by Air Force Lt. Col. E. W. Schenck on board the U-2 aircraft. Navy attack aircraft carrier to which the astronaut was taken after flight



Left photo shows Carpenter being assisted out of pressure suit and placed in the aircraft (left). Center and right photos show Carpenter at Grand Turk Island where he was taken for medical examination and debriefing. Astronaut Lt. Col. Walter S. Schenck, in center photo, was Carpenter's backup

Compact Bioastronautic Sensor Tested

By Harry Miller

Yonkers, Calif.-based, Spacelabs devices based on a previously observed physiological effect may offer a simple, noninvasive method of obtaining important readings of respiration rate and respiration volume from astronauts in the space flight.

The device, known as an impedance pneumograph, makes use of the fact that changes in the measured nose-thorax impedance—a measure of the resistance of respiration across the chest of a human or animal—will have a direct quantitative relation with respiration volume, the amount of respiration gas the body inhales and exhales. Change in impedance can be measured simply by attaching two surface electrodes, one on the anterior and one on the posterior of the chest, using a transducer with a bridge circuit, and observing impedance changes in an oscilloscope or pen chart recorder.

Spacelabs, Inc., a small organization located here that specializes in biological and medical equipment for space has developed one such impedance pneumograph in flight hardware. The device is small and light enough (roughly 1 in. by 2 in. by 12 in. and weighing 4 lb or), slightly smaller than a pocket radio, to be carried on an astronaut's body. It can be strapped on and provides a signal for monitoring heart, or chest without requiring removal of the suit without respiration sensors or sensors on less. Other companies, including E&M Instrument Co., Houston, Tex., are working on similar devices.

Laboratory Experiments

The idea for monitoring respiratory activity in the human was suggested by Dr. J. A. Godleski and physiologist Dr. John C. Goss of the University of Texas in the year in "Aviation Medicine," the journal of the Aerospace Medical Assoc. Godleski described his early laboratory experiments and found the best electrode position, the point of maximum impedance change, at the level of the sixth rib in man and dog.

Godleski, employed at Aerospace Medical Research Institute, performed pneumographs on man to obtain respiratory data on later Mercury flights in the Gemini and Apollo programs. McDonnell Douglas Corp., prime contractor for Mercury and Gemini, has prepared a device built by Godleski which will build the device under contract to National Aeronautics and Space Administration, presumably for use on Mercury and Gemini flights. Spacelabs will supply two devices to NASA for its evaluation.

This technique appears to have significant advantages over previous

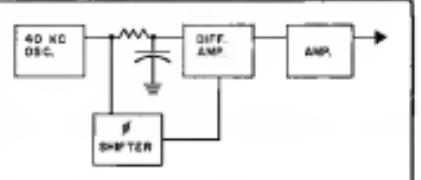
methods of securing respiratory measurements, especially where the subject is in the suit for an extended time in space, remote, adverse environment, as would be in a space station or module.

Spacelabs demonstrated the operation of the device using the respiratory of a subject. Electrodes were attached to either side of the chest and the output of the unit (either a signal or a current) was fed into an oscilloscope. The output waveform appears as an oscillating waveform with amplitude corresponding to respiration rate and volume, respectively. A high, deep breath appears as a wide and large pulse than several pulses in the train. Similarly, a high, deep breath shows as a narrow, high pulse.

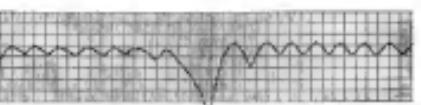
Heart Rate

Heart rate shows up as regular pulses displayed on a screen as heart beat oscillations. An electrocardiogram can be obtained from this by passing the output signal through a separate filter and amplifier.

The device can be tested if the heart is held directly and moved rapidly causing a shift in the baseline, possibly because of other electrical movement or changes in body position, such as a sneeze. With the arms held above and forward of the head,



FUNCTIONAL DIAGRAM of impedance pneumograph signal conditioner shows body impedance measured by capacitor. Output is suitable for oscilloscope display.



PEN CHART recording of output from impedance pneumograph tested continuously for a 24 hr period on a human subject at the School of Aerospace Medicine, Brooks AFB, Tex., is a typical waveform which can be obtained by device made by Spacelabs, Inc. Impedance corresponds to subject deeply breathing in for about a sign at completion of difficult psychological test. Heavy dots occurring periodically on the waveform are steady level voltage pulses caused by heart beat.

GOOD REASONS TO SPECIFY PACKARD FEP TEFLON®-INSULATED CABLE

• **BUILT-IN UNIFORMITY** FEP Teflon-insulated cable can be extended in continuous lengths (measuring thousands of feet) without splices. The high temperature insulation is uniformly dense the entire length of the cable.

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CREATIVE ENGINEERING PLUS EXPERIENCE = RELIABLE SYSTEMS FOR CRUCIAL MISSIONS



IMPEDANCE PYROMETER uses two surface electrodes attached to either side of the case containing explosive charges inside the fuse. These charges are related to explosion rate and volume. The light weight metal enclosure shown here provides a current signal, modulated by implosion rate suitable for display or telemetry. Device is made by Spartekle Inc., one of several companies investigating fuse designs that are often a simple technique for measuring implosion rate and volume of explosion.

waking nations. They might be expected to be employing or developing even local control devices, the information continued, to cover through space.

For flight application, the pilot or astronaut would be calibrated beforehand using the same signal conditioner and electrodes to be employed as him as later flights. Any significant changes in volume between a preflight record and the record being subtracted during the flight can then be spotted.

The spaceman device was subjected to a 74 hr vibration test on a vibration subject at the School of Aerospace Medicine Brooks AFB, Tex. A plasma-liquid telemetry system transmitted data obtained from the subject. A portion of the recording showing an impulsive dip in the waveform at the time of a difficult paracutaneous test, is clearly visible.

A 500 kg payload generates the basic power for the spaceman though each human is the maximum explosive charge appears to take place between 30 kg and 100 kg. The body impedance forms part of a voltage divider network on which the current is inversely proportional to the voltage divider detect impedance changes.

A balance adjustment is required to vary the amount of anapolar voltage applied to the difference amplifier and causes out-of-balance of the shunt output, Spartekle said. This reduces the noise level and dynamic range required by the amplifier. If the noise is not reduced, the company points out, an excessive dynamic range would be needed because of the amount of gain required to develop a suitable output signal.



space Ideas on propulsion



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WHEN DESIGNING FIVE POUNDS
INTO A ONE POUND SPACE...

USE



ABOVE: A-4 Skyhawk. LEFT: hi-Lok fasteners are being used to assemble the front and rear fairings of the A-4. BELOW: hi-Lok fasteners provide strong, secure and reusable fastening for many light spaces.

LEFT: hi-Lok fasteners are being used to assemble the front and rear fairings of the A-4. BELOW: hi-Lok fasteners provide strong, secure and reusable fastening for many light spaces.



LOWE: The effects of the hi-Lok fastener can be seen in the strength and security and of assembled structures. hi-Lok fasteners are being used to assemble the front and rear fairings of the A-4. BELOW: hi-Lok fasteners provide strong, secure and reusable fastening for many light spaces.

If space is a problem, use hi-Lok. If your structure is open and many fasteners are required, use hi-Lok automatic driving techniques. Check your Engineering Standards Group for details.

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NEW AEROSPACE PRODUCTS

Complex-Number Slide Rule

Device is used to calculate complex numbers and functions in the same manner as a standard slide rule for computations relating to space and electronic problems. The rule operates by adding and subtracting the logarithms of complex numbers plotted on a plane or the rule. A regular slide rule does straight line real number operations.

pat. pend. 31/75 action switch generates. Power is supplied with a motor operating on 12 v.d.c. at 6 amperes or 28 v.d.c. at 3 amperes. The motor is capable of continuous operation at full voltage. Total weight of the pump is 3 lb.

Weldon Tool Co., 3900 Woodhill Rd., Cleveland 4, Ohio.

Refueling Nozzle

Aluminum nozzle weighs 10 lb. and is attached to the underside of an air craft wing for refueling by an aircraft.

which prevents flow until the nozzle has been locked to the aircraft.

The nozzle engages in the adapter which is 40 deg. cone. Locking lever is moved 90 deg. to lock on and begin fuel transfer. After fueling, the locking lever must be closed again before the nozzle can be disconnected from the adapter.

The nozzle is made of 6061-T6 with a pressure drop of less than 5 psi. All critical parts can be replaced without complete disassembly. Inferior metal parts are made of non-conductive stainless steel or aluminum bronze, inconel, titanium, etc.

Berkley Iron & Brass Works, 124 E. Third St., Dayton 1, Ohio.



The employee-member rule has two plinths, one sliding on the other. A granite ringstone on the outer plinth is divided into the quadrants of the Axiom diagram.

Results can be read off polar form from the rectangular axis or in Cartesian form from the coordinate coordinates. Corresponding Axiom quadrant is shown shaded above each of the four quadrants. The rule is made of brass and plastic measures 15 in. in diameter and 17 in. long. It is predrilled at 10° to 15° to 20° to 25°.

Tachikawa, 2-2444, Whitehead Blvd., Santa Monica, Calif.

Aircraft Fuel Pump

Model 1 pump is designed for passing fuel injection nozzles, pressurizing fuel tanks at takeoff and emergency use.

Features include an adjustable pressure relief valve which is controllable in flight. Manufacturer says the pump has a capacity up to 50 gph at 14



It can at Levitt. Levitt specializes in magnesium

to meet your needs. Levitt can control it to produce precision aircraft and aerospace components that meet critical specifications, exceeding performance requirements. Major contractors rely on Levitt for sheet metal subcontracting ... in magnesium, titanium, nickel, aluminum, stainless steel and other alloys. Write for brochure detailing Levitt quality controlled services: Designing / Production Planning / Sheet Metal Forming / Welding / Machining / Metal Finishing.



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WHERE SCIENCE FICTION BECOMES SCIENTIFIC FACT

Place: Hoffmann Science Center, Santa Barbara, Calif., where the Advanced Projects Group of Hoffmann's Military Products Division is engaged in a variety of original research and development programs. Among these:

- **Laser modulation and demodulation.** While investigating a variety of approaches, Hoffmann scientists have conceived an original technique for direct quantum electronic modulation.

Hoffmann Research News Service/1964-Aerospace Division
for future military space flight. (Continued on photo continuation page 11/25, weight 11/17)



This and others are being developed in prototype, aimed at application to point-to-point communications.

■ **Economical solar power supplies.** To meet the increased power requirements of large spacecraft, Hoffmann Science Center is investigating a variety of techniques and materials. These promise greater efficiency, reliability and flexibility from lighter-weight solar power supplies for future orbiting and planetary space stations.

■ **Solid-state travelling wave devices.** Hoffmann scientists are using the piezo-electric properties of gallium arsenide to develop dc power conversion devices. Their goal: improved efficiency for systems in a wide variety of fields, including ASW.

■ **The men of Hoffmann's Advanced Projects Group are converting science fiction into scientific fact. They lead strength to, and gain strength**

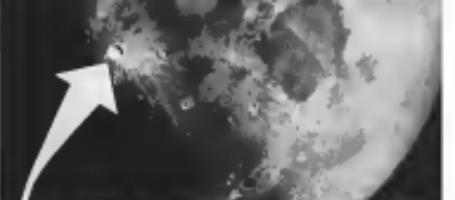
from, the Military Products Division's extensive background in communications, reconnaissance, navigation and surveillance systems and devices.

Once anomaly of transponder and receiver performance creates problem. Hoffmann research and its ability to control wide dynamic range of communications is increasing communication at broad bands.

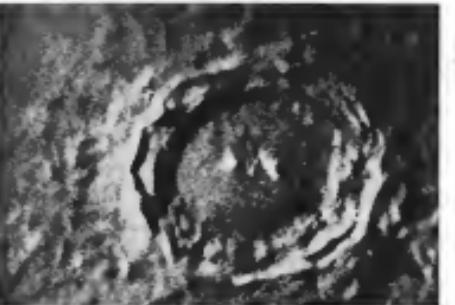


Hoffmann

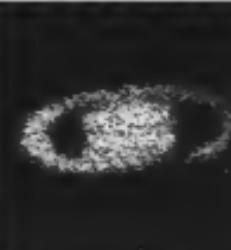
ELECTRONICS CORPORATION
Military Products Division
2310 South Grand Avenue, Los Angeles 7, Calif.



Large photo-optic tracking telescope was used to take some photo above. Arrow points to crater Copernicus. Crater of Copernicus, shown in photo below, was taken with Air Force's TV telescope.



USAF's television telescope views Jupiter (left), bringing planet's bands into clear view. Photo below shows rings of the planet Saturn.



Satellite Tracker Utilizes Television For Image Clarity

Air Force Manned Test Center is testing a satellite and missile tracking system which combines a 24-in. aperture television telescope with a television image orthicon system replacing the conventional photographic recording system. USAF says the TV system provides sharper exposures with less image motion caused by atmospheric turbulence than a photographic system, with resulting reduction of distortion. The planet photos above were taken to test the TV telescope tracker and have practical usage almost as good as the best astronomical photos ever shot, according to the AFMTC space tracking group. Photo at right, taken at Patrick AFB, shows the 25,000 ft telescope antenna tracking a missile launched from Cape Canaveral. Fin, 25 mi. to the north.



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SURFACE...



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The Grumman A-10 Mohawk is a twin turbo-prop aircraft designed for electronic surveillance and observation missions. It features short-field capability for maximum operational flexibility. It's an all-weather craft—when the birds are grounded in snow, ice, or mud, the A-10 will complete its assigned mission. The MOHAWK configuration offers:

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landing • operation from unimproved areas •
good low-speed control • drop tank and supply
pod capability • adaptability to various types
of photographic and electronic equipment.

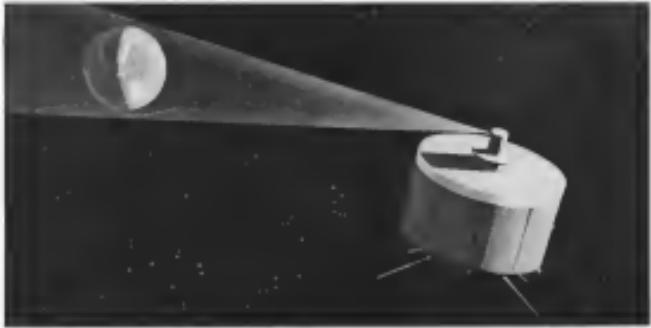
Long a producer of reliable aircraft, Grumman
now also develops new concepts in electronic
systems integration, missiles, and space vehicles.

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HUGHES 3600 COMMUNICATION SATELLITE will have separate antennae which will use 16-element array in which phase of each element is controlled to produce pencil beam with variation of phase in satellite spin rate to keep beam earth oriented.

New Telemetry Multiplex Idea Proposed

By Philip J. Klass

Washington—Fundamentally new approaches to telemetry multiplexing, which present important advantages over presently used time and frequency multiplexing for some applications, were several days during the recent National Telemetry Conference.

Telemetry is known at Lockheed, a contractor of "telelogic" waveform analysis equipment. It was reported by A. H. Buffard of Lockheed Electronics Co., Washington D. C., a recently formed joint venture in the instrumentation field.

Concerning waveforms with frequency division multiplexing, the new technique has the advantage that it requires only a single oscillator to generate the need for local, earth transmission, and permits bandwidth saving by reducing the guard band spectrum. Buffard said:

Coagreed with time division multiplexing, Lockheed permits use of a simplified type of antenna telemetry and eliminates the possibility of frame skipping. Additionally, it is far more flexible than time division multiplexing in channel capacity, which can be increased simply by adding more modules, Buffard said.

During the session and another period following Buffard's report, a National Bureau of Standards scientist called the new technique "extremely intriguing."

In other aspects delayed at the National Telemetry Conference, which present important advantages over presently used time and frequency multiplexing for some applications were several days during the recent National Telemetry Conference.

■ **Data transmission compression** ranging from 10:1 to as much as 400:1 appears realizable by using a multi data processor aboard a telelogic system vehicle to limit the data transmitted back to those measurements which have undergone a significant change, from previous values.

Studies of telemetry rates indicate that more than 91% of the data now transmitted back to earth can be easily measured by using a multi data processor capable of handling 10,000 samples per second at

independently for each channel and so that the levels can be changed by command from a central station.

■ **Ultra-wideband telemetry** appears feasible by providing approximately 12 db gain over the frequency range of 120 mc to 2,400 mc to accommodate the coming shift of telemetry from VHF and the microwave region was described by John D. Owen of the University of Illinois. The antenna consists of a circular polarized array of four crossed log-periodic elements. Owen said the University of Illinois, in cooperation with the USAF's Aerospace Systems Division, has demonstrated a compact quad-polarized array which has been tested over the 40 mc to 4,000 mc band. It provided 30 db and 45 to 55 db.

■ **Antennas-supported downlink**, which can be used to adapt present VHF telemetry services for use in the new 2,200-1,800 mc telemetry band, was reported by Walter L. Winter of the Naval Air Systems Facility. The down converter consists of a low noise mixer and a local oscillator fed by a local oscillator, stabilized to within $\pm 0.0005\%$, with a 2.232125 megahertz local oscillator of the mixer. The existing VHF telemetry receiver then becomes, in effect, an intermediate frequency amplifier of a double superheterodyne version. Use of a low-noise parametric amplifier at the down-converter would improve system performance, Winter advised.

Coagreed with time division multiplexing, Winter said, is the use of a simplified type of antenna telemetry and eliminates the possibility of frame skipping. Additionally, it is far more flexible than time division multiplexing in channel capacity, which can be increased simply by adding more modules, Winter said.

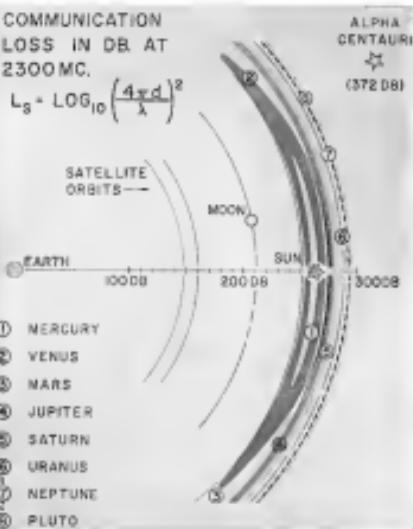
During the session and another

period following Winter's report, a Space and Communications Division Systems engineer, Lee Rohn of Dynatec Systems and Owen J. Ott of Data-Comm Systems reported a separate report. Ott Ott cautioned that while a properly designed pre-detection receiving system provides data acquisition equal to or better than conventional data and detection systems, and can handle any different type of telemetry format, some characteristics of system components which would lose no performance for post-detection systems will adversely affect post-detection systems. A four-channel pre-detection system which Data-Comm Systems built for Lockheed used a mix of frequencies of 700 hz for recording and demodulation, Ott said. An important potential advantage of pre-detection recording, Rohn said, is the possibility of using resolution techniques to resolve waveforms which otherwise would be lost in noise. However, before this potential can be realized, improvements are needed in the time base stability of the record/reproduce hardware, he said.

■ **Adaptive digital telemetry systems**, using one of several ground-to-vehicle feedback techniques show considerable promise of improving avionics performance and reliability, according to a report presented by Bernard Hirsch and R. C. Sonnen of New York University. The most promising of several feedback techniques is the "adaptive" or "self-timed" digital technique. Using this technique, a space vehicle would transmit only a half message, then pass to base from the ground-based telemetry station as to the quality of the signal received. If an acceptable signal is reported the vehicle would proceed with its next message, if not, the original message would be repeated. The length of the message transmitted before each pulse would depend, as just occurs, on the time of the received fraction of each message, Hirsch said.

For short distance, the vehicle might transmit only a single digit before waiting for confirmation, while at longer range a eight transmit a number of digits to measure overall noise. However, if the first digit received is not of acceptable quality, the telemetry station would interrogate the vehicle message.

■ **Standardized modules and subfunctions** also a promising way of achieving the extremely long life and high reliability required for space-qualified vehicles, was reported by Paul M. Johnson of the Jet Propulsion Laboratory and Southwestern Research Institute. Such standardizations would make it feasible to re-use modules and reengineering effort in making early "over-the-air" design and in trials to find observable differences



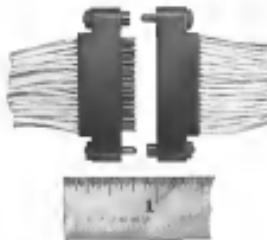
COMMUNICATION LOSS IN DB AT 2300MC.
 $L_g = \log_{10} \left(\frac{4\pi d}{\lambda} \right)^2$

SOLAR SYSTEM DISTANCES is based by a communications engineer from a semi-logarithmic chart as expressed in decibels of attenuation at 1,000 mc. Chart was prepared by National Aeronomy and Space Administration's Jet Propulsion Laboratory.

out. However, Rohn cautioned that when such standardization is achieved, certain diagrams must assist the junction to modify or make small changes in the design, thereby saving lots of rework. Rohn also called for development of "reliable and predictable reliability analysis" and "reliability prediction." There is currently no rule of thumb between the mathematical distribution and the working capacity," he said.

■ **Modular shock-isolated type** modules, designed to operate in the presence of 1000 shocks of 15 kilonewtons or longer duration and vibration of 10 g, was described by R. S. Anderson of Weber Aircraft Corp.'s electronics division. Instead of using a conventional option to drive the magnetic tape, the new recorder uses a continuous stainless steel belt which contains and transports the recording tape. Tens to 1000 shocks will be fed into a useful life of excess of 100 hrs. of operation, Anderson said.

■ **Directive systems** for spinning satellite, such as a communications satellite in a synchronous equatorial orbit, which require no moving parts aboard the vehicle was described by B. S. A. Rohn of Hughes Aircraft Co. The technique is a more advanced version of the existing "spin" system. NASA-Hughes' spin communications satellite, Sigma, will use an antenna that produces a figure-eight radiation pattern which sweeps out a square-shaped radiation pattern in the arc of the orbital



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plane as the satellite spins. While this is more efficient than an uncontrolled rotation pattern, only a small portion of the total energy in the uncontrolled pattern is directed toward the earth. The more advanced the satellite, the more it can be controlled. In the middle, we can take an array of 16 elements arranged symmetrically around the spin axis and displaced from it by approximately one wavelength. By controlling the relative phase of energy supplied to each element, a narrow narrow beam can be formed, and by varying these phase relations at the rate of one at which the satellite is rotating about its spin axis, the radiated beam will sweep around the satellite. This is called a phased-clamped-rotating pattern. This allows the satellite to communicate in phase with a series of a finite adaptation of the Faraday plane filter. Thus, the shifting beam could be controlled in a way which would be modified by a click pulse used to compensate for the apparent drift motion of the sun about the earth.



SACRIFICIAL RADIATION PATTERN directed toward north from Hughes System results from rotation of figure-eight pattern produced by dipole. Below, severe availability requirements for space stations in terms of total operating hours is shown as a function of time that such continuing lifetimes will be needed.

Oxytropis multiflora

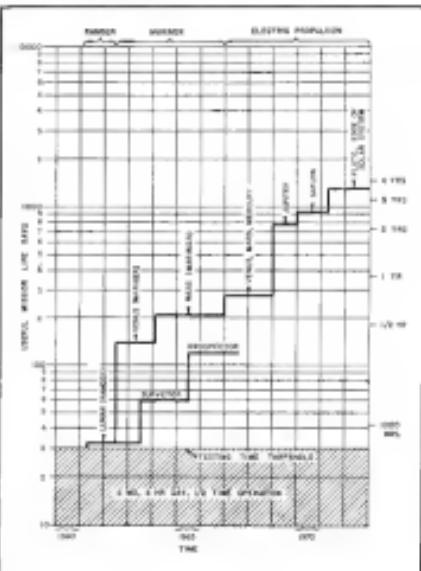
New Orthoines multiplying tick sage described by Bellard and others and polyvalent washers as our next steps which can be tremendous contributions, over a single channel without encumbrance.

For analog type telecenters, informal input is received by direct, unaided telephone notification of the computer facilities. For digital telecenters, information is entered in simple patient records of the computer system. Specimen storage is "at least as efficient and in some cases more efficient than existing methods," Bellard said.

Optowave technology is applicable to any multi-channel system including voice, telepresence, telepathy and digital data link. Bellini and An experimental four-channel analog system constructed by Edward L. Bellini and to prove the theory provides 90 cps response and 15% accuracy in all channels, he reported.

Concept involves the use of carrier signals which are orthogonal polynomial functions of time. Two signals are said to be orthogonal if their product is integrable to zero over that time interval.

That six main sets of waveforms which satisfy this condition. Bellard explained. For example, the wave and cosine waves of harmonically related frequency are orthogonal within any time period which is an integral number



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of order at such frequency. Another example is a set of non-overlapping pulse signals with a time period exceeding all possible times.

Properties of helical transitions and in the new technique are those which are polynomial functions of time—those which can be expressed as finite sums of algebraic terms each of which is some power of time.

An Ofsthofen test can now be matched after correlation process to separate the various and to recover the subseries in each channel. The fact that the carriers are orthogonal makes

maximum cross talk between channels.

The Ofsthofen circuit built by Bell

and Howell demonstrated a maximum rejection ratio of 40 dB. Bell and Howell say the ultimate performance is not yet known.

To achieve synchronization and calibration, it is only necessary to train out an unmodulated reference signal over one channel, it is noted.

In response to a question from the floor, Bell and Howell emphasized that there may be a practical upper limit to the number of channels which can be processed because of the increased number of integrators required for each added channel.

British Developing Concentrated, Depressed ILS Localizer Beam

London—Addition of a localizer to the Standard Telephones & Cables Stan 7 locator has depressed approach beam to 25 deg above the horizon, significantly reducing possible interference by overflying aircraft.

Testing now is under way at Elstree Airport to project the system toward ICAO Category 1 performance, capable of full approach guidance in an automatic landing system. Important issues would be elimination of the localizer cable system now used, to be replaced by a radio signal. Experimental Use is anticipated, and initial Aviation Agency at Atlantic City, N. J.

By adding the localizer, STC team led by F. H. Taylor has concentrated the beam into its first lobe, substantially improving ILS solutions above the 25 deg angle. Previously, the unmodified Stan 7 lobe reached an elevation of about 50 deg.

In addition to reducing reflections

from overflying planes, the modified unit produces a more efficient beam which requires less power from the transmitter. Taylor and colleagues say that fully transnational equipment is possible.

STC has integrated its nose and clewless aerial arrays into a single beam unit, with the clewless aerial mounted on top of the interior rather than a separate mast behind the nacelle (AW Aug. 5, 1962, p. 78) as now is on Stan 7 (London). The new unit is also under construction at Farnborough.

All three are the Stan 7/5/9 system, comprising a dual beam localizer (Stan 7) for narrow glide path equipment (Stan 8), and a wide beam Stan 9 System, installed under \$8.2 million. Ministry of Aviation contract worth ICAO Category 1 and 2 separations.

FILTER CENTER

► **Improved Radar Lenses on Helicopter** Improved increase in efficiency of radar lenses is expected in the near future when greatly improved radar crystal he come available. Link Co. says pattern of reflectors for linear lens, expected to reduce return scattering, caused by its partners, by factor of 10.

► **Patent Application for Improved Radar** Patent application for a new system to reduce noisiness for operation over water and over land masses which do not have ground-based aids is under study by Patents and Trademarks Office for linear lens, expected to reduce return scattering, caused by its partners, by factor of 10.

► **Heat Rate Control Proposed** Simple, lightweight system by which a space vehicle can control reentry, based on direct measurement of rate of change of velocity, has been proposed by J. S. Hollands of AC Electronics, Inc., Division of General Motors at the recent National Aerospace Electronics Conference in Dayton. Primary inputs to the system



MODIFIED STAN 7 LOCALIZER atop Elstree Airport redesigns both nose and clew aerials for sharper deflection of beams in atmospheric landing. Clewless aerials are the three major division at center.

M.I.T.—Raytheon science team hits moon with light from powerful Raytheon laser

On the night of May 9 last, a team of scientists from the Massachusetts Institute of Technology and Raytheon scored an impressive electronics first—hitting with a beam of ruby light a mountainside area northeast of the crater Alphonsus, on the surface of the moon. Proof came within 24 seconds following each of 13 successive hits, when the reflections of the light returning back to the earth were recorded on an oscilloscope. To back up these historic ball-bearings, the research team called on the most brilliant coherent light source yet developed—a powerful new Raytheon laser.

Unhurriedly, lightwaves spread out,

loss intensity as they travel. But with the "light" bouncing across the face of the laser (a light amplification system), it is now possible to generate and project a needle-sharp shaft of light—many times brighter than the sun—in a straight line over great distances. A man on the moon, in the area stimulated, would have had no difficulty in recognizing the laser beam because an earth wave signalized to him. The light, after its 238,857-mile trip, was still as bright as a flashlight bulb.

Raytheon was among the first to develop an operating laser, and has been a pioneer in new laser concepts. Pulse lasers promise to lead

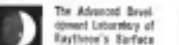
themselves to military applications and to new techniques in communications, radar, medicine, space vehicle guidance and control, fabrication and processing, and a host of other still unforeseen uses for the benefits of man. This is Raytheon research and development at work, serving business, industry, science and defense. Can Raytheon electronics help you?

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Our prime function is exploring and developing electronic capabilities. In addition to the continuous laser program, typical Advanced Development Laboratory projects include: Masked Filter Communication Systems, theoretical and experimental work on Spherical Resonators, investigation into High Level Microwave Energy Absorption by Gases, techniques for extracting information from raw signal data.

Your responsibilities are carried to a point where capability credits for one of the Engineering Departments is embark on analysis of the data. The results of your participation in such projects will frequently be of sufficiently high level to interest publication.

The Laboratory provides sufficient assistance from service groups to enable you to pursue theoretical and experimental work free from the problems of production, administration and red tape. The well-equipped experimental facilities include a computer in full-time service.

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would come from telecine sky temperature sensors supplemented by a hemispherical vertical gas reference. Pilot would measure to monitor skin temperature rate versus pressure levels. The entire control system would weigh 100 lbs. and require no more than 15 watts of power. Dabrowski estimated. Previous analog simulation and digital computer studies of the proposed temperature rate flight control system have been conducted, he said.

► Area Coding Cuts TV Bandwidth

Channel compression ranging from 4:1 to 25:1 in the transmission of single frame television-type images has been achieved using techniques known as Area Coding, developed by the Philips Corp., and announced by its Texas Division, Dallas.

The talk paper reported at recent National Aerospace Conference in Darton, by Richard A. Schlegel of Philips and Robert L. Ranson of ASD, represents an average in terms of four sets of blocks of elements instead of separately transmitting individual elements or linear arrays of elements of constant brightness.

► Optical Satellite Near Test—Stanford University will soon begin tests in which two solar optical lasers will be held fixed to produce an annular beam to generate an ion current in space. The test will open the new era of lasers for a potential communications system. In isolating the output of one of the lasers, Dr. A. E. Siegman of Stanford told the recent National Aerospace Conference in Dallas.

Laboratory experiments used a single solar laser with heterodyne produced by two different wavelengths among the same current in a laser's output. The laser beam was demonstrated by directing a portion of the envelope of a conventional tracking solar array mounted in a platform.

The platform contained a detector array mounted on the opposite side of the array from the tracking array, which was then amplified by the tracking array tube. Siegman is now producing a modified version of a TWT with more sensitive photo-cathodes which are currently available for such applications, Siegman said. He added that Stanford's work in laser modulation and demodulation has advanced to the point where the university would like to work with system engineers to obtain grants in funding a laser-based test development of devices they need.

► Supersensitive IR Detector—Infrared detector, which is said to be 10,000 times more sensitive to infrared waves than the previously sensitive units in the one to five micron region, has been announced by Minnesota Mining & Manufacturing Co.

The device uses an indium antimonide crystal, cooled to a temperature of 77K. Detector output is 1.060 volts per watt of 500K black body radiation. Detector is being produced by Honeywell's Electro-Optical Facility at 1985 Avenue of the West, Los Angeles.

► First Wrist-up Table Developed

Concentric moving table which becomes operational within 1.3 sec after power is applied, composed with a vertical frame, is said to be the first concentric-gear table to range 24 sec. The concentric-gear table-type table has been developed by General Electric's Research Division, Duke Estate, Goshen, N.Y.

The rapid warm-up is achieved by use

of two techniques: bonding a shield to the heater, while retaining electric insulation, and use of a helix heater in series with heater to permit a relatively high metal surge of current through the heater. GE says it has applied techniques experimentally to two tube types: a triode-cathode-anode and a tetrode triode as part of its feasibility study. The heater for cathode bonding to shield remains untried, up to now.

► **Mixer Bibliography Published**—The Nuclear Energy Commission has published a bibliography of reactor core gas and solid-state vacuum and lasers, mixing devices, designs and operation. The

31-page report, catalog NUREG-1100, Series Series 1000, Item 310 596, is available for \$8.25 from the Office of Technical Services, Commerce Dept., Washington 20540.

► **Posing Laser Reliability**—In a series of radiation generated laser experiments with single crystals will be arranged in an effort to develop models with which to reduce doubts in materials in forthcoming program to be conducted by the Avco-Everett Space Group. AF-SWE is using potential technique to explore one of the more difficult problems in the field—the

inconsistency of high intensity radiation. The 1000 program, scheduled for 15 months duration, will explore a study of measurement methods, then the analysis of new methods and development of devices for exploring these methods. Initial proposals for both contracts due late June 15.

► **Horizontal-axis-focused Klystron**—Experimental model of an electron-beam-focused klystron, potentially capable of use in space communications, has generated 20 kilowatts of peak-pulsed power at 1430 MHz in test conducted under a research contract in search program at the Electron Tube Division, Litton Industries. Higher powers are expected from development of the klystron which should be smaller and lighter than magnetically focused klystrons.

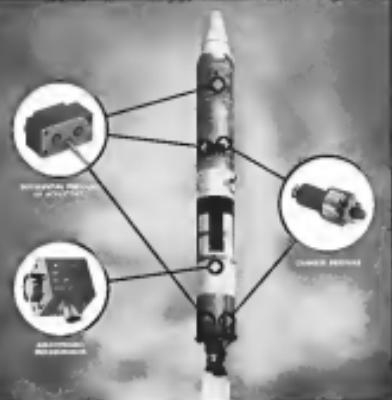
► **More Liquid Laser Funding**—Possibilities of obtaining speed timer action or a liquid and distance-adversely high powers from the liquid lasers are attracting Air Force interest. Gen. and Precision Laboratories was asked recently to conduct a liquid laser feasibility study for Avco-Aerospace Systems Division under a \$40,000 contract. Space Technology Laboratories also is running an investigation of liquid lasers for Space Systems Division.

► **Aerospace Mergers, Acquisitions**—List of continuing series of mergers and acquisitions of aerospace companies include:

• **Telodyne, Inc., Los Angeles, has acquired Antenna Systems, Inc., Hasbrouck C.M., from Schlumberger Well Surveying Corp., American, Boston, which probably will operate as a Telodyne subsidiary, has done R&D efforts in magnetohydrodynamics, magnetooptics and other computer components which coincide with computer interests of America, Inc., another Telodyne subsidiary. Telodyne is headed by Dr. Ernest E. Sington, a former vice president of Litton Industries.**

• **Microdot Inc., So. Pasadena, Calif., manufacturer of antenna instruments, has merged with Vantec Inc., Cambridge, Calif., manufacturer of industrial control devices and telemetry systems. Combined sales of the two organizations are running at annual rate of \$10 million per year. Vantec will operate as a wholly owned subsidiary of Microdot.**

• **RF & Hewlett Co. and Data, Inc., Cleveland corporation, plan to merge on the basis of an agreement in principle approved by the directors of both corporations.**



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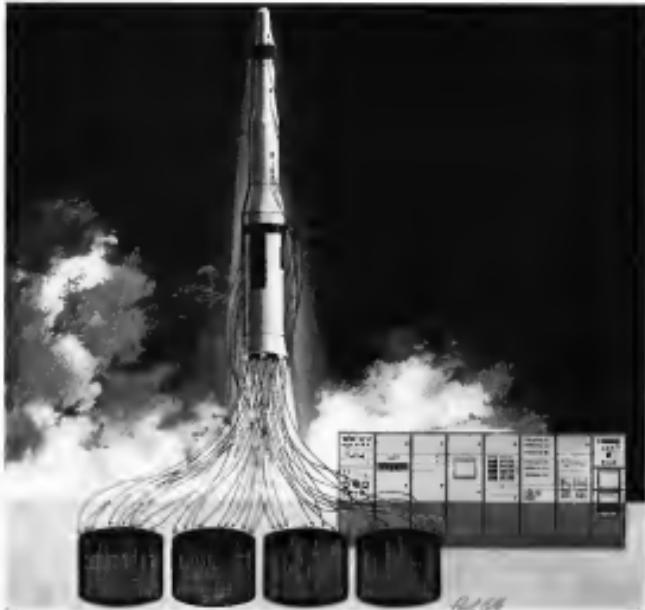
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AT RADIATION, CHALLENGE IS OPPORTUNITY

Example: Advanced data systems to speed Manned Mars

Manned a reed plane. It's 322 channel real-time telemetry equipment for instant visual analysis by test crews. The high-line-level PCM multiplexing system — designed and produced by Radiation Electronics — measures in mere seconds an entire test handling system. It's produced in less than a cubic foot of space, weighs only 40 pounds, and will yield maximum performance data from each test fire.

Radiation also develops a broad instrumentation for convert Nimbus's 252 telemetry channels into display form for real-time analysis by test crews. And, the company produced four complete ground data-processing systems to monitor and record information from off-digital telemetry and guidance equipment.

Radiation's scientists and engineers have entered the age of satellite instrumentation with competence in data acquisition and processing for aerospace and range instrumentation.



Communication systems - Data acquisition and processing - Automatic selection - ST systems - Micro-technology



MEN OF MARS

ENGINEERS AT ASTRONAUTICS 'ORBIT THE EARTH'

In this mockup model of "MARS" — Manned Astronautical Research Station — engineers are making simulated space flights at General Dynamics' Astronautics in San Diego, California.

The MARS vehicle, placed in orbit by Atlas-Centaur (also designed and built by Astronautics) could take three astronauts 200 miles into space for almost a month of scientific studies.

MARS typifies the advanced planning and technical resourcefulness that have made General Dynamics' Astronautics an ideal association for space minded engineers. We're also at work on such Atlas-Centaur programs as Mariner—a deep space probe to the vicinity of the planet Venus—and Surveyor, which will soft-land an instrumented package on the moon.

Atlas Centaur is the free world's first space vehicle to be powered by liquid hydrogen. It not only opens our entire solar system to research, but creates extraordinary opportunities for engineers who look beyond the present state-of-the-art — men who are somehow not content with the status quo.

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galaxy effectiveness of down systems launched from the missile in flight. The last of these tests is expected to lead to improvements in U.S. missile designs and anti-missile discrimination systems.

- Monitor unguided space launches at all-distant links in the world-wide chain of tracking stations which are used to follow U.S. unguided orbital flights.
- Provide 24-hour coverage of all three polar orbits.

- Formulate meteorological requirements.
- Evaluate sea-launched ballistic missiles such as the Navy's Polaris.

The radio antenna, weighing approximately 1.5 tons, was designed to prevent edge deflection of more than 26 in. from heat, wind or ship motion. It is a C-band transponder with a Cassegrainian reflector.

Studies have been conducted to insure that the antenna and barbells have a resonant frequency greater than that from the vibration frequency excited by the ship's motion. Studies are to prevent the antenna from being damaged by the ship's motion.

The mobile ocean stations are to be equipped with an integrated polarimeter (composed of C, L and X-band tracking and data receiving equipment). The C-band transponder is an improvement of Sperry's AN SPG-55 gun fire radar for the Navy's Talos missile and has gyro slopes on its 30 dB. return to provide line-of-sight stabilization.

Tracking data will be measured for roll, pitch and yaw of the missile against measurements obtained from the ship's inertial Navigation System (INS). Angle and range data are obtained from a gyroscopic system to measure target orientation in real time.

The integrated tracking system will incorporate control central modules to associate both orientation, reference or navigation, error reduction, tracking devices and both in testing equipment.

Telemetry Equipment

Telemetry signals from the missile target will be received through a second receiver. The receiver system is a dual, and the two signals will be cross-correlated over a third, omnidirectional antenna to a transponder on a carrier aircraft and down link to Cape Canaveral for analysis. The ship's equipment will permit range, transmission and decoding of all intended modulation techniques.

Telemetry antennas can also be used as radio direction finders in searching for beacon-equipped nose cones or recovery packages. The telemetry system has self-test capability, control console, timing controller equipment and tracking gear.

The carrier SINS system will be periodically checked and corrected through the use of a reference vector device located above the bridge which will automatically compute star fixes.



TRANSMISSION TOWER on Navy's first ship includes two antenna which beam signals at the NAVFAC C-100 radio station to bring up the letter system and test it for gain, beam width and pole load levels. Testing these systems will be shipped to Honolulu for evaluation about one of the two NAVFAC ships.

Timing return on the omnibus tracking station will trigger ANIR (ANIR) from a station at the Cape which is synchronized with time at the U.S. Bureau of Standards. Time signals received by the ship are analyzed to be accurate within 10 microseconds.

Signals from the Naval Observatory Station WWV will be used to synchronize the ship's clocks.

Computer System

Data processing system for the ship's instrumentation system will consist of a Convair 1266 computer designed for displayed use and eventually the same type of computer as the one now being evaluated at the station on Aircrew Island.

The 1266 computer will have no memory and will have a sustained calling speed of 17.5 k/s when not engaged in tracking operations. Personnel aboard will include 100 engineers and 100 instrumentation specialists.

Associated Companies

Other companies associated with Sperry Rand Corp., Sperry Gyroscope's parent company, in the NAVFAC project are: Battelle Seattle, ship's navigation and navigation, Gidds & Cox Inc., carrier architecture and supervision of ship construction, and ITT Federal Laboratories, telemetry and tracking gear, communications and meteorological systems.

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FUTTER AS-48 high performance powered sailplane was developed jointly by Aérospatiale SA, Flugzeugbau, and Germany's Institute of Powerplant Dynamics. Aircraft is now undergoing flight testing after transients development.

Hanover Exhibits Include Utility Aircraft,

By Edith Wallord

Hanover, West Germany-Swiss Aérospatiale PC 6 Porter and Italy's Aeromacchi Lockheed 60 light aircraft made strong sales bids at the Hanover Air Show for the share of the expanding utility market.

Exploiting the fast increasing potential of their respective aircraft in a number of configurations, both firms featured at least five different adaptations in the outdoor displays. Multi-purpose configurations demonstrated by both aircraft at the show included passenger and cargo transport, as aerial survey, supply drop, aerial photography and surveying, paraplane training and crop spraying.

During the show May 14, p. 56, the single-engine Aeromacchi Lockheed 60 (six-passenger, all-metal aircraft and the eight-passenger Flugzeugbau PC 6 Porter demonstrated their patrol, air-sea search and rescue, and landing capabilities with portable equipment upon the STOL capacity of the Porter.

In the opinion of a number of observers, the comparatively low price of the Aeromacchi Lockheed 60 could fit in, at least somewhat, the sales appeal of the larger Porter's improved general performance, including the STOL capability of the Turbo Porter, the Turbopax. Aeronautics, turboprop-powered version first introduced at the Paris Air Show last June.

The standard Flugzeugbau-powered

Aeromacchi Lockheed 60, powered with a 250 hp Contessa 500, has a maximum speed of 160 mph, landing at 50 ft. It can fly 1,000 miles on a 100-kg payload. The aircraft is finding a good outlet in Kenya, Rhodesia and South Africa, according to Macchi. A major selling point in these areas is the aircraft's cargo capability. Does its original passenger or cargo carrying configuration to other areas, or closing crop-dusting and ambulance work.

Macchi says that it also hopes to receive sales to the United Kingdom where the Lockheed 60 is being offered as a replacement for the Hawker Siddeley Dragon type aircraft.

Of the 55 Aeromacchi Lockheed 60s sold thus far, Macchi has built and delivered 27. Of these, one was sold to England, two to Canada, one to Australia, five to South Africa, one to Denmark, one to France and four to



AEROMACCHI LOCKHEED 60 all-metal multi-purpose aircraft is built by Hanover Aeronautics Macchi SpA. It is shown fitted with skis for snow or grass operations.



HINKEL GREIF TA sailplane was shown at Hanover this year for first time. Vehicle a 13.62 ft. long, and has wing span of 49.21 ft. and wing area of 310.34 sq. ft. Aircraft made its first flight in December, 1960.

New Sailplanes

the U.S. The first aircraft sold to the U.S. were orders passed to Macchi for completion by Taskforce Aircraft Corp. The aircraft are in service with a number of sport clubs throughout Italy.

In addition to its multi-purpose character for which special equipment is available, the Aeromacchi Lockheed 60 can be fitted with Fliebel-type dual astrodome in nose and main wheels, which enable it to taxi off or land on annual markers of one snow and permit take-off at approximately 15-ft. radius.

Test flights of the upgraded version in the U.S. are planned.

As an alternative to the Lockheed 60 can accommodate two passengers, it can also fly a two-seater glider in addition to a standard astrodome and pilot. To allow full cabin utilization, the cockpit has a separate entrance on the left side of the fuselage. This also includes a small window to increase visibility.

A large 43 x 35 ft. door on the right hand side of the fuselage provides room for loading or off-loading the structure within the cabin. Stanchions are located one above the other behind the pilot's seat. Sliding seats fixed to the cabin floor facilitate loading and unloading.

Other features of the Aeromacchi 60 are: high wing, single main-mounted leading gear, wide stability wingtip, landing gear fairings supported by two 5 x 17" hexagonal cross-brace boxes and large 20 sq. ft. Fowler flaps.

The Flugzeugbau PC 6 Porter, built by Flugzeugbau Werke Ltd., currently



PIPLATZ PC-4 agricultural version (above) demonstrates crop-spraying capability. PC-4 (below) provides ample leg room for eight passengers. Opened opening door permits loading of freight items up to 17 ft. long in cargo version.



RENDEZVOUS ROUTE OR COLLISION COURSE?



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Pilots of U.S. Navy fighter planes will shortly be able to rendezvous or fly in formation with greater security under a wider range of conditions... for they'll know exactly how far they are from each other. ■ As far as ranging will be added to their present TACAN sets with the General Dynamics Electronics—Rochester 90-704 modification kit. No big gear! It's a "best seller" fighter that the cutouts it replaces, it permits as many as 5 planes to judge their distances from a sixth such as a group leader or air tanker. Convincing? Hardly—negligible—only 3 feet hours. And the 90-704 actually improves the

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Dassault Spirale 3 Transport Design Shown

Model shows design details of Avions Dassault's monomotropop Spirale 3 which won recent French air force competition for a small transport aircraft. (MW Feb. 14, p. 41). Prototype is two Turbomeca Turmo 3D engines developing 1,265 hp on takeoff.

is being produced at a rate of three to four aircraft per month. Since the first protoype engine, prototype was introduced at the 1959 Paris Air Show, a total of 12 have been built. Eleven of these were sold to domestic users plus one each in Finland, Sweden, Holland, West Africa and France. Four have been sold in West Germany and five in Nepal. French customers have in other two on order. Of the remaining aircraft, the company has three for demonstration purposes and retains the rest at its plant.

In addition, Dassault is working on the acquisition of orders for some standard Porter fitted with a supercharged 340 hp Lycoming GSO-315

HP6 piston engine and seven Turbo Porters with the Avions 2-510 ship prototype. Seven of these will go to Alaska, the remainder to Asia and the Middle East.

Last June, the company was granted certification for an increase in tare weight of its supercharged 140-hp Avroport Porter from 1,975 lb. to 4,530 lb., which would be attained performance.

Like the Avroport, Lockheed 10, the Porter can be converted to a wide range of duties, including transport of cargo loads weighing up to 1,150 lb. in standard configuration; it can even seven passenger plus pilot.

As an ambulance, it has space for two stretchers plus three passengers and pilot. In addition, it is being used for aerial photography and survey work, spanning with a normal cargo load capacity of 185 U.S. gal. Under contract, Aviation Agency CAR-3 regulations, up to 280 gal can be carried if required.

It also can be used for supply drops and paratrooper training.

Serbian's Sud-Aviation Co., agent for the Pilatus PC-6 Porter in Scandinavia is currently testing a special air ambulance version of the Porter with parts made in Edo Corp.

Sikorsky Exhibit

The Sikorsky exhibit also included three airplanes shown here for the first time. They were:

■ **Geot 1A**, built by Ernst Heinkel Flugzeugwerke GmbH, a high-performance single-seat vehicle with a shoulder-wing construction, which flew for the first time in December, 1956.

■ **Geot 1b**, a single-seat, end-wing standard class powered seaplane fitted with a BMW Type 8316 200-hp radial engine with a takeoff thrust rating of 113 lb., also being constructed by Heinkel.

■ **Puma**, MS-50 high performance powered seaplane, with retractable landing gear and automatically folding propeller, fitted with a 100-hp two-cylinder ILO engine, built in Altona Pomerania, Germany, for the Polish Flying Association, the Polish Flying Association, and the Polish Flying Association, (AVM Ma. 2, 1956, p. 77). Large numbers of Pumas have been ordered by the West German Defense Ministry for training purposes, and others are in service with West German sport clubs. Developed in cooperation with the

Aermacchi Lockheed 60

(260 hp TSO-47/48 Continental engine)

Weights

Empty weight	1,760 lb.
Useful load	1,970 lb.
Takeoff weight, long range	3,970 lb.
(B)	4,300 lb.

Performance

Cruise speed at 40% power	165 mph
5,000 ft. no head wind	215 mph
Takeoff distance at 40% head wind	515 ft.
in 100 ft. altitude	approx. 950 ft.

Cruise speed at 40% power: 165 mph
5,000 ft. no head wind: 215 mph
Takeoff distance over 90 ft. altitude: 515 ft.
in 100 ft. altitude: approx. 950 ft.
Landing distance at 40% head wind: 790 ft.
in 100 ft. altitude: 1,500 ft.
Range: 1,000 miles
Endurance with max fuel: 4 to 10 min
plus 30 min. on reserve fuel

USAF Seeks Control of Technology Gains

Washington—Air Force has begun to play greater emphasis on control and careful selection of advances in technology which can be applied to future weapon systems.

This is partly the result of the Air Force's desire to bridge the gap between the work of the research scientists and military operational requirements, and partly due to criticism coming in the office of the Director of Defense Research and Engineering (DODRE) concerning the lack of consensus in creating new weapon systems.

At present that function is performed principally in the office of advanced technology in the office of the Deputy Chief of Staff for Research and Technology at USAF headquarters. The office is being expanded through the formation of a new Air Force Systems Command (AFSC) division for research and technology.

The nucleus of this division has already been formed by the addition of Col. James M. Sisk (AFM 82, p. 17). Its permanent commander when it approaches full strength will be Maj. Gen. Marvin C. Donler, who at present is the director of advanced technology.

The advanced technology group must devote its attention to a wide front of knowledge.

It is in the management area between the scientist and the problem that lies that in returning the attention of the

advanced technology office. Too often in the past, it was explored, a design group was made from findings derived from applied research into the development of a weapon system. Sometimes this approach was successful, sometimes it was not.

In many instances the lack of clear planning based on state of the art advances in technology resulted in quickly changing the design and going into over time. One DODRE officer has noted that Air Force weapon development projects have sometimes run only original cost estimates even as high as 300%.

In addition, some programs had an array of risk and uncertainty about them. Some did not work out at all or were only partly successful.

The determine of advanced technology was formed to bridge the gap between the basic and applied research and the operational needs stage.

The nucleus of this division has already been formed by the addition of Col. James M. Sisk (AFM 82, p. 17).

Its permanent commander when it approaches full strength will be Maj. Gen. Marvin C. Donler, who at present is the director of advanced technology.

The advanced technology group must devote its attention to a wide front of knowledge.

It must serve basic research experiments to determine which are feasible for future weapon systems. Basic research must also examine the

level of nature in what can be done with them. Those experiments that look promising for future use in weapon systems are funded for applied research.

Applied research consists of trying to build a component of a system at a laboratory as "small-scale" as possible to see if it will work.

Things that can be done must then be scaled up to those the need to be done. Requirements are generated in a variety of ways, predominantly by the military services themselves. This concept is currently changing with DODRE and other offices of the Office of the Secretary of Defense stating requirements that they believe fulfill the roles and missions assigned the services. They are acting in not down scale an subsystems being developed for defense dollars.

The present technology team is no team that cannot be converted to a research and development organization stage. It is considered that the technology needs to move parallel programs in which the program could be affordable but not too expensive. Generating revenue will remain in such stages longer until early design demonstration superiority.

The sequence of events in the creation of a weapon system begins with combining technical, political, developmental and domestic economic and political considerations with plans, negotiations and basic research. This combination of concepts and techniques is called a Required Operational Capability (ROC).

From the ROC, a list of Long Range Development Objectives is drawn down. These are modified for Qualitative Operational Requirements (QOR).

It is at this point that the calling process begins, resulting in Advanced Development Objectives (ADO). Advanced technology is applied to separately components, which are combined to become advanced systems.

Finally, a Specific Operational Requirements (SOR) is written for each weapon system and development begins.

An example of strict control of the final stage of a weapon is in DODRE's Q34A Standardized Space Launch System, formerly called Titus 3 (AFM May 26, p. 26). No funds have been released by DODRE for the Phase I, or development stage, of this system pending final decisions on the configuration of the booster stage. Configuration of all other stages have been determined.

Another example of advanced technology management at work is the concurrent development of Aerospace Plane, a vehicle which could take off



Bristol Siddeley Displays V/STOL Model

British Siddeley model shown at Hanover show is one possible configuration for a light to medium weight V/STOL transport built around the Fairey 35-15 variable-thrust engine series. Doctor Wylie is now developing a similar aircraft under government contract doing the Do. 31 (AFM Apr. 9, p. 25).

Germany: Flight Research Establishment (Deutsche Versuchsanstalt für Luftfahrt und Raumfahrt) of Braunschweig, work on the MS-80 began in 1970, and it recently entered its flight test stage. The two-place-powered aircraft features zero gain in lift-off thrust, a maximum speed of 1,181 ft. per minute, a rate of climb of 7,97 ft. per second, a range of 300 miles, a rate of climb of 43 ft. per second, and a maximum glide ratio of 12.2 at 31 mph.

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PRIVATE LINES

Antennae Society formed by group of members of South Reading a London which has pointers to Marconi at Avon Park, Florida, a group of experts in development of Northolt Airport or center for London business Park. This group is based in British Aircraft Corp. Airtel, which has unofficial industry support, is to run Northolt jointly with RAE.

Perf. Foundation will use a Convair Model 120-30 aircraft in its education and research development programs in India and Pakistan. Aircraft will be based in New Delhi.

Kawasaki's Bell 47G

Modified version of the Kawasaki Bell 47G-2 helicopter designed primarily for crop spraying and dusting, is being produced by Kawasaki Aerospace Co., Ltd., Japanese licensee for production of Bell 47G and 47G helicopters.

New model has 37 ft. min. 2 ft. longer than the previous 47G-2, and payload has been increased from 100 lb. in the 47G-2 to 175 lb. in the 47G-2A. The 250-hp. engine has not been changed.



RELATED PROJECTS such as the Stargazer and Spies which are intended to demonstrate the feasibility of using space power in spaceflight, are coordinated between government agencies as shown in the above diagram.



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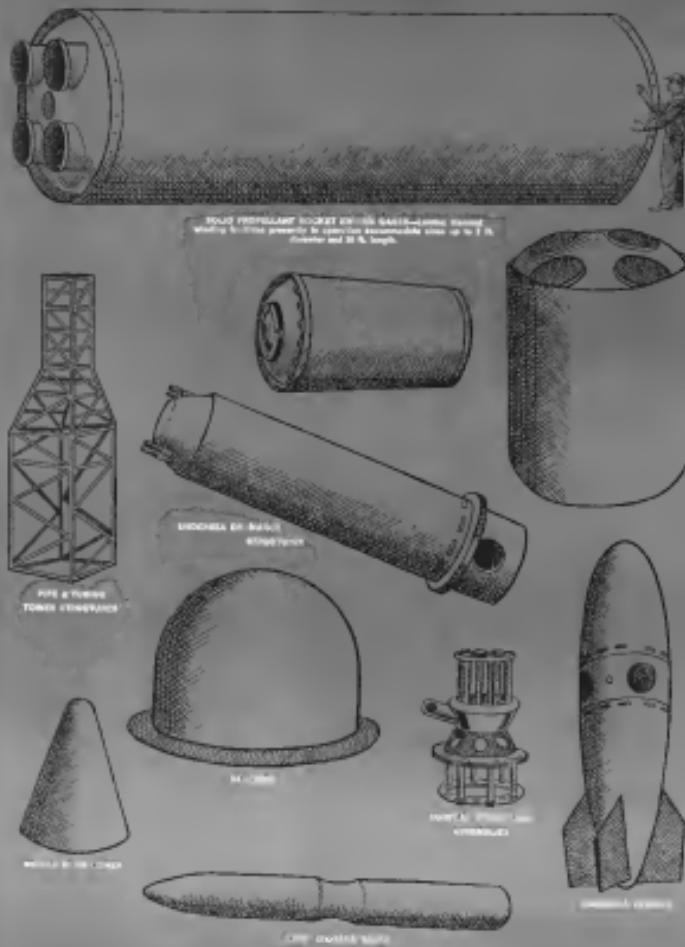
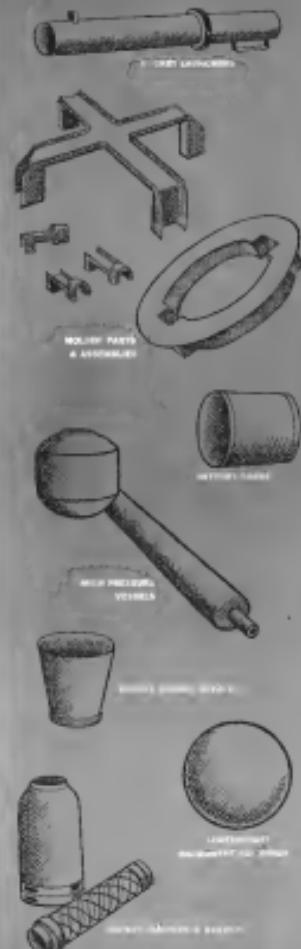
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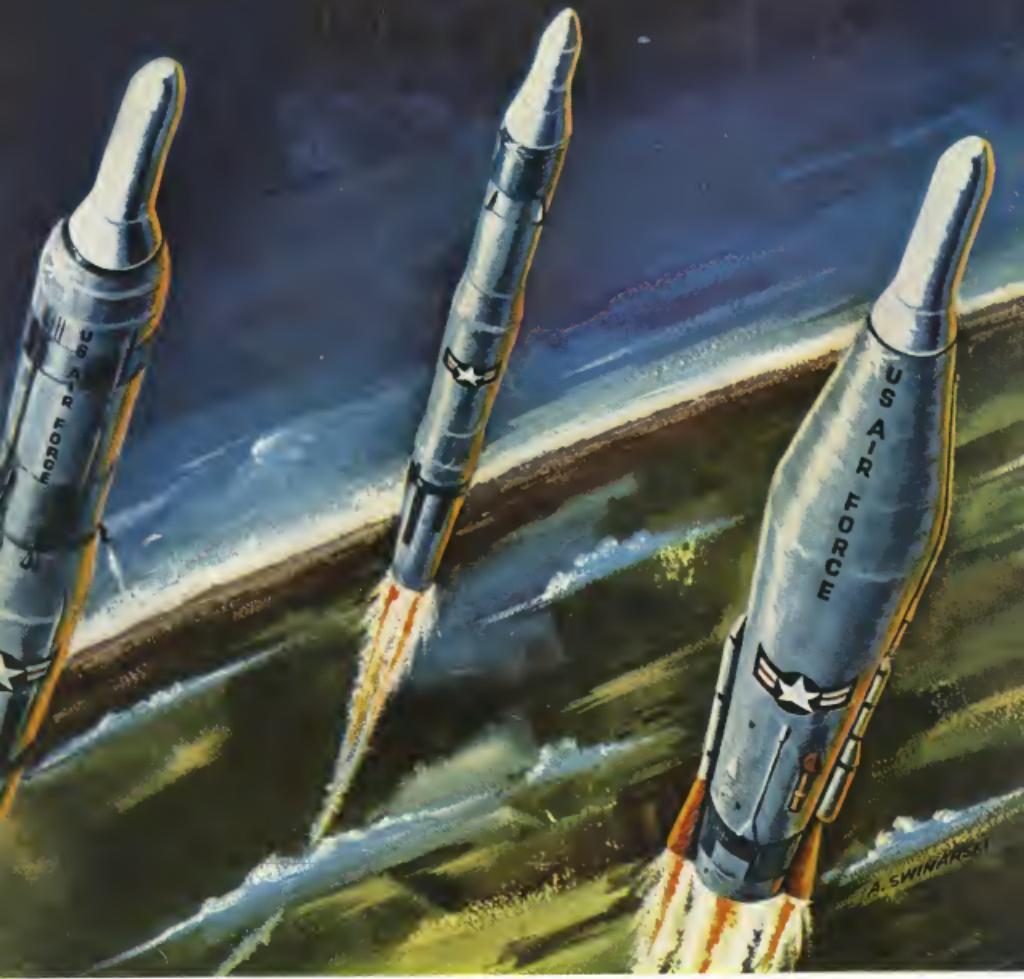
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